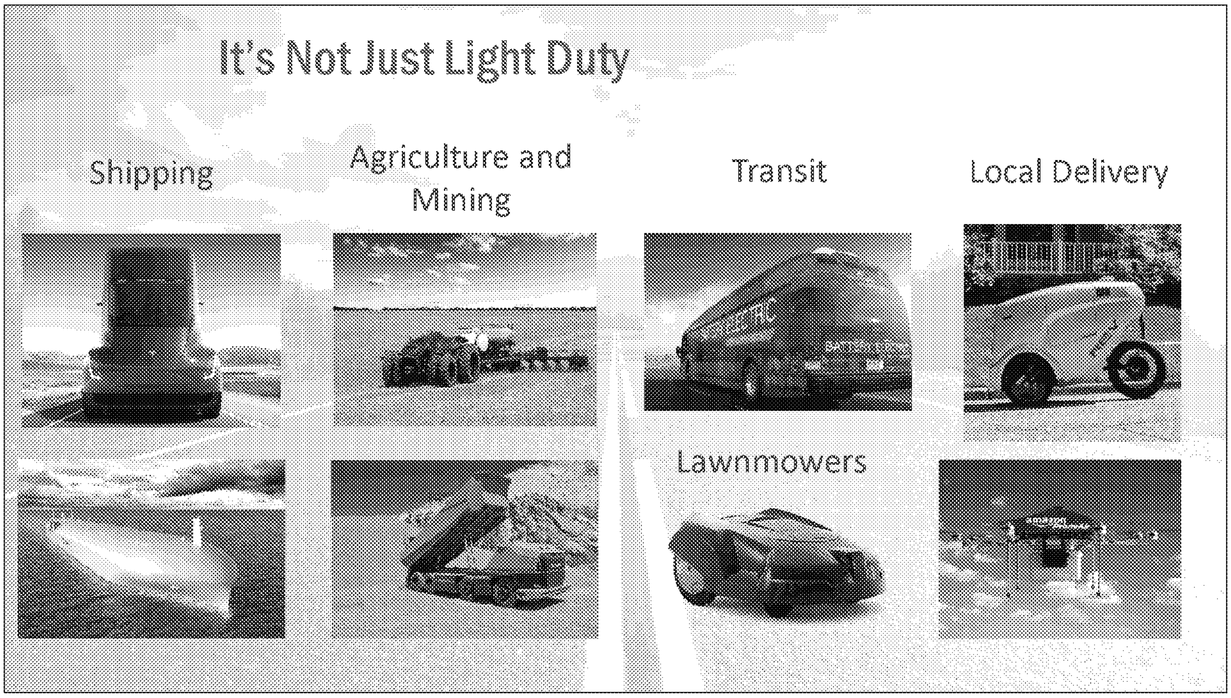
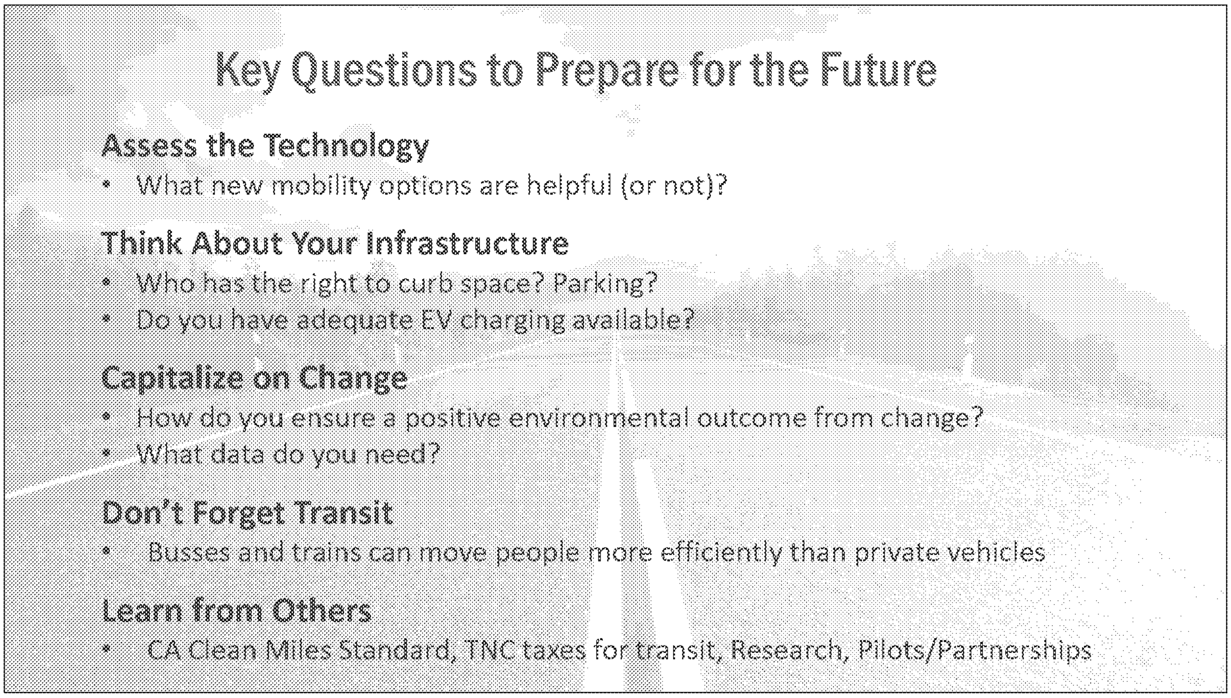
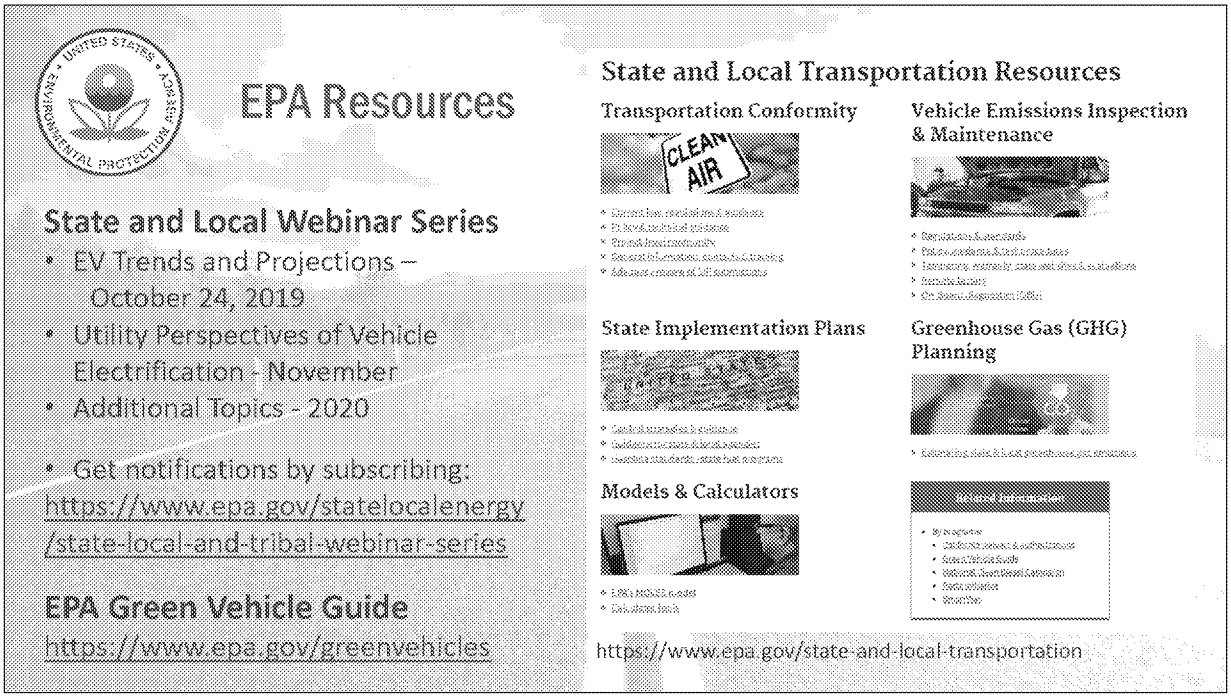


- Amazon ordered 100,000 electric delivery vans from Rivian

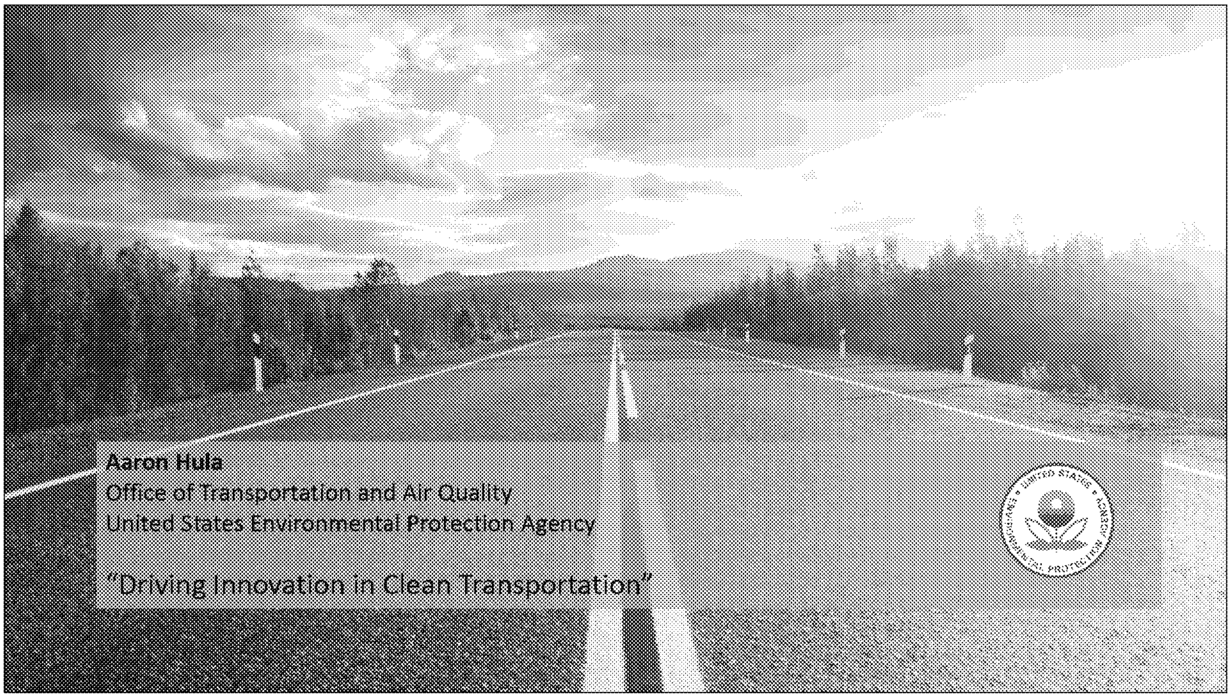


CA Clean miles standard
Reduce GHG emissions from TNCs on a per-passenger mile basis

CA Sustainable communities (CA 375)
Encouraging metrics beyond throughput



- EPA hosts webinars to help state, local, and tribal staff as they explore, plan, and implement energy efficiency and renewable energy efforts. These webinars highlight EPA resources tailored for state, local, and tribal governments; feature presentations by state, local, and tribal experts; and share examples of successful state, local, and tribal programs and policies.


Aaron Hula
Office of Transportation and Air Quality
United States Environmental Protection Agency
"Driving Innovation in Clean Transportation"
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Message

From: Machiele, Paul [machiele.paul@epa.gov]
Sent: 3/17/2021 7:49:54 PM
To: OAR Briefings [OAR_Briefings@epa.gov]; OTAQ Materials [OTAQMaterials@epa.gov]
CC: Charmley, William [charmley.william@epa.gov]; Borgert, Kyle [borgert.kyle@epa.gov]; Burkholder, Dallas [burkholder.dallas@epa.gov]; Herbolsheimer, Courtney [herbolsheimer.courtney@epa.gov]; Dubey, Susmita [dubey.susmita@epa.gov]; Greenglass, Nora [Greenglass.Nora@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Lie, Sharyn [Lie.Sharyn@epa.gov]
Subject: Briefing for OAR tomorrow on "eRINs Under the RFS Program"
Attachments: eRINs for OAR 3-18-21.pptx

Message

From: Hula, Aaron [Hula.Aaron@epa.gov]
Sent: 3/19/2021 12:49:43 AM
To: Charmley, William [charmley.william@epa.gov]
CC: Simon, Karl [Simon.Karl@epa.gov]; Moran, Robin [moran.robin@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Snapp, Lisa [snapp.lisa@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Ellies, Ben [ellies.ben@epa.gov]; Sherwood, Todd [sherwood.todd@epa.gov]; Graff, Michelle [graff.michelle@epa.gov]
Subject: Vehicles vs. Standards update
Attachments: 2021_03_18 Current vehicles vs Standards.xlsx; 2021_03_18 Current vehicles vs Standards SUMMARY.xlsx

Bill,

Attached is the updated vehicles vs the standards analysis for model year 2021, as requested. Thank you to Michelle Graff, who was able to do most of the analysis this year.

As in years past, the 2021 footprints, and for large trucks the engine/footprint combinations, are assembled from a combination of publicly available data and historic data and should be treated as preliminary. This analysis applied the A/C credits as originally projected (which are about on track – for 2019 cars achieved 14.8 g/mi vs 15.8 projected, and trucks achieved 20.2 g/mi vs. 20.6 projected). It does not apply any off-cycle credits, but it would be straightforward to apply some level of off-cycle credits if you'd like to see that (in 2019 cars achieved 4.3 g/mi and trucks 9.7 g/mi).

I've attached two files, one is the summary list of 2021 vehicles sorted from best to worst versus the SAFE standards, and the second file is the full analysis. Feel free to reach out to Michelle and I with any questions.

Aaron

Message

From: Charmley, William [charmley.william@epa.gov]
Sent: 4/9/2021 5:51:04 PM
To: Safoutin, Mike [safoutin.mike@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Moran, Robin [moran.robin@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Ellies, Ben [ellies.ben@epa.gov]
CC: Simon, Karl [Simon.Karl@epa.gov]
Subject: FW: Connecting EPA & Benchmark Minerals Intelligence
Attachments: CNBC video article on EVs and lithium-ion battery production in the U.S.

Dear all –

When I listened to this CNBC video yesterday (see attached email), they interviewed a person from Benchmark Mineral Intelligence. That name range a bell, but it wasn't until today I remembered why.

When the OAR leadership met with Tesla a few weeks ago, and also in the meeting OTAQ had with Tesla on Feb 25, Tesla had an estimate of what the capital investment would be to build EV auto plants, and maybe also battery plants. I was very interested in knowing more about that work, and as a follow-up to the discussion, Joe Mendelson from Tesla provided me with this email of introduction to Simon Moores at Benchmark Mineral Intelligence.

I would like to talk about the potential for some technical engagement with this company, and I would like to know if we could have this on the Agenda for our meeting on Monday at 11:05, and I would like Mike Safoutin to join for that discussion.

Thanks
Bill

From: Simon Moores <smoores@benchmarkminerals.com>
Sent: Thursday, March 25, 2021 4:16 AM
To: Joseph Mendelson <jmendelson@tesla.com>
Cc: Charmley, William <charmley.william@epa.gov>; Elizabeth Eckert <eeckert@benchmarkminerals.com>
Subject: Re: Connecting EPA & Benchmark Minerals Intelligence

Thanks Joe

Ex. 4 CBI

All the best,

Simon

Simon Moores | Managing Director

Benchmark Mineral Intelligence

On 22 Mar 2021, at 20:29, Joseph Mendelson <jmendelson@tesla.com> wrote:

Bill,

Ex. 4 CBI I am connecting you here with Simon Moores, head and founder of Benchmark Minerals Intelligence: https://www.benchmarkminerals.com/

Ex. 4 CBI

My best,
Joe

Joseph Mendelson | Senior Counsel | Public Policy and Business Development
1333 H Street, NW, 11th Floor West | Washington, DC 20005
c 703.244.1724 | e jmendelson@tesla.com

<image001.png>

<image002.png>

<image003.png>

<image004.png>

Message

From:	Charmley, William [charmley.william@epa.gov]
Sent:	4/9/2021 2:06:09 PM
To:	Safoutin, Mike [safoutin.mike@epa.gov]; McDonald, Joseph [McDonald.Joseph@epa.gov]; Cherry, Jeff [Cherry.Jeff@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Sherwood, Todd [sherwood.todd@epa.gov]; Nelson, Brian [nelson.brian@epa.gov]; Cullen, Angela [cullen.angela@epa.gov]; Moran, Robin [moran.robin@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]
Subject:	CNBC video article on EVs and lithium-ion battery production in the U.S.

Dear all –

This article from yesterday from CNBC is a 15 minute video report, all about EVs and lithium ion battery plants and potential U.S. manufacturing shortfalls on production to meet demand.

I know it's long, but I think it is very worthwhile.

Thanks

Bill

https://www.cnbc.com/2021/04/08/the-us-is-facing-a-lithium-ion-battery-shortage-with-ev-growth.html

As automakers continue to grapple with a semiconductor shortage, some experts say the next supply chain crisis for the U.S. could involve lithium-ion batteries. As companies like GM, Ford and a slew of start-ups ramp up their electric vehicle ambitions, current battery production in the U.S. won't be able to keep up with demand. Though the U.S. has a handful of large-scale battery manufacturing facilities, including Tesla's Gigafactory that operates in partnership with Panasonic, a trade dispute between two Korean battery makers, LG Chem and SK Innovation, threatens the future of a new battery factory in Georgia.
Source: CNBC

From: NADA Headlines PM <nadaheadlines@nada.org>
Sent: Thursday, April 08, 2021 4:28 PM
To: Charmley, William <charmley.william@epa.gov>
Subject: GM to Halt Production at Several North American Plants Due to Chip Shortage

Click here to view this message in a browser window.

April 8, 2021

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Closing Numbers

- Dow: +0.17%, up 57.31, close 33,503.57
- Nasdaq: +1.03%, up 140.47, close 13,829.31
- S&P 500: +0.42%, up 17.22, close 4,097.17
- Crude Oil: +0.02%, up 0.01, close 59.78

Top Movers in Auto Retailing

- Group 1: +1.93%, up 2.98, close 157.05
- Sonic: +1.81%, up 0.89, close 50.18
- CarMax: +1.63%, up 2.05, close 128.15

Top Movers in Auto Manufacturing

- Tata: +2.40%, up 0.49, close 20.94
- Volkswagen: -2.16%, down 0.78, close 35.50
- Ford: -1.73%, down 0.22, close 12.51

Other Top Movers in Auto

- AutoWeb: +4.91%, up 0.14, close 2.99
- HyreCar: +4.73%, up 0.52, close 11.51
- TrueCar: +3.85%, up 0.19, close 5.12

End-of-Day Recap

- General Motors Co. will halt production at several North American factories and extend shutdowns at some others because of a protracted shortage of semiconductor chips that is disrupting the auto industry's hopes for a bounceback this year. The auto maker said Thursday that three plants previously unaffected by the chip shortage will be idled or have output reduced for one or two weeks, including a factory in Tennessee and another in Michigan that make popular midsize sport-utility vehicles. Vehicles affected include the Chevrolet Traverse SUV, and the Cadillac XT5 and XT6 SUVs.

Source: The Wall Street Journal

- Volkswagen's luxury sports car unit Porsche AG might have to adjust production to reflect an ongoing shortage of crucial automotive chips, Handelsblatt reported. "We cannot rule out that we will lower the volume of some models in the near future," the company was quoted as saying by Handelsblatt, without giving more details. The lack of semiconductors, which has roiled the global car sector, caused General Motors Co to announce earlier on Thursday extended production cuts at some of its North America factories.

Source: Reuters

- As automakers continue to grapple with a semiconductor shortage, some experts say the next supply chain crisis for the U.S. could involve lithium-ion batteries. As companies like GM, Ford and a slew of start-ups ramp up their electric vehicle ambitions, current battery production in the U.S. won't be able to keep up with demand. Though the U.S. has a handful of large-scale battery manufacturing facilities, including Tesla's Gigafactory that operates in partnership with Panasonic, a trade dispute between two Korean battery makers, LG Chem and SK Innovation, threatens the future of a new battery factory in Georgia.

Source: CNBC

Finish Line

- The San Benito Food Pantry received a donation of a van during the first week of March. A Nissan dealership in New Braunfels donated the van to the pantry. According to Forest Walker, the President of the San Benito Food Pantry, she was searching for a vehicle to make pick up donations since the beginning of the year. Walker first contacted the dealership in January. Walker said that she did not ask for them to donate it. She was originally looking to buy and see what deals could be made.

Source: San Benito News

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Message

From:	Blubaugh, Jim [Blubaugh.Jim@epa.gov]
Sent:	4/20/2021 9:56:04 PM
To:	Birgfeld, Erin [Birgfeld.Erin@epa.gov]; Hengst, Benjamin [Hengst.Benjamin@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]
Subject:	RE: Draft Administrator Briefing Memo for upcoming ZEVTC meeting
Attachments:	EPA Administrator Briefing Memo_ZEV Transition Council.docx; ZEVTC Ministerial Agenda.pdf; CCC_ZEVTC_Ministerial_Slides.pdf; ICCT_LCA study April2021.pdf

Erin,

I agree with your proposal and am happy for you to send forward those three documents to Sarah tomorrow morning. She has already seen the Administrator memo that I drafted this afternoon and is happy with it. For you to move the complete package forward to her I have attached it here again.

Actually there are a few more documents that I have included on this note to add in as attachments:

ZEVTC Meeting agenda
CCC presentation
ICCT presentation

I realize that OITA has already shared a ton of background documents with the Administrator's office but I would prefer they not get bogged down in all the material and only focus on the relevant material from us.

Finally please respond to Sarah's note and let her know our plan for moving the docs forward.

Thanks,
Jim

From: Birgfeld, Erin <Birgfeld.Erin@epa.gov>
Sent: Tuesday, April 20, 2021 5:31 PM
To: Blubaugh, Jim <Blubaugh.Jim@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>
Subject: FW: Draft Administrator Briefing Memo for upcoming ZEVTC meeting

Jim,

I propose that we send all three items to Sarah tomorrow morning and she can then send all three items to Joe and Ale. Are you OK with that or were you thinking of moving this ahead without the talkers.

Adding in Ben in case he wants to provide guidance.

-Erin

From: Dunham, Sarah <Dunham.Sarah@epa.gov>
Sent: Tuesday, April 20, 2021 5:28 PM
To: Birgfeld, Erin <Birgfeld.Erin@epa.gov>; Blubaugh, Jim <Blubaugh.Jim@epa.gov>
Cc: Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Mroz, Jessica <mroz.jessica@epa.gov>; Burch, Julia <Burch.Julia@epa.gov>
Subject: RE: Draft Administrator Briefing Memo for upcoming ZEVTC meeting

Thanks—I could use some help laying out the review process. Please suggest who is sending what to whom and by when. Ie, should we (who) send all three docs to OAR briefings and when, and then asking Joe and Ale when they are comfortable to send the pieces forward to whom? Anyway, I'm not understanding the sequencing you all have in mind.

From: Birgfeld, Erin <Birgfeld.Erin@epa.gov>
Sent: Tuesday, April 20, 2021 4:52 PM
To: Dunham, Sarah <Dunham.Sarah@epa.gov>; Blubaugh, Jim <Blubaugh.Jim@epa.gov>
Cc: Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Mroz, Jessica <mroz.jessica@epa.gov>; Burch, Julia <Burch.Julia@epa.gov>
Subject: RE: Draft Administrator Briefing Memo for upcoming ZEVTC meeting

Hi Sarah,

I think we should send the TPs with the memo and appendix if time allows. I am taking a last look at a first draft of the TPs and will send them shortly.

-Erin

From: Dunham, Sarah <Dunham.Sarah@epa.gov>
Sent: Tuesday, April 20, 2021 4:19 PM
To: Blubaugh, Jim <Blubaugh.Jim@epa.gov>; OTAQ Materials <OTAQMaterials@epa.gov>
Cc: Birgfeld, Erin <Birgfeld.Erin@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Mroz, Jessica <mroz.jessica@epa.gov>; Burch, Julia <Burch.Julia@epa.gov>
Subject: RE: Draft Administrator Briefing Memo for upcoming ZEVTC meeting

Thanks this looks good. when the "appendix" is ready one of us should ship both docs to OAR briefings. Erin, were you planning on sending the talking points separately straight to maria or would you suggest sending those to OAR with the memo?

From: Blubaugh, Jim <Blubaugh.Jim@epa.gov>
Sent: Tuesday, April 20, 2021 3:37 PM
To: OTAQ Materials <OTAQMaterials@epa.gov>
Cc: Birgfeld, Erin <Birgfeld.Erin@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Mroz, Jessica <mroz.jessica@epa.gov>; Burch, Julia <Burch.Julia@epa.gov>
Subject: Draft Administrator Briefing Memo for upcoming ZEVTC meeting

Sarah,

I have attached a draft of the Administrator briefing memo for the upcoming ZEVTC meeting we discussed during our meeting this morning with Joe, OITA and the Administrator's staff. I think it captures the substantive information on the ZEVTC and notes there are talking points in the works. It does not include the attachment which will include the tools, etc... discussion that you noted – Erin is working that angle right now.

Please take a look and let me know what you think.

Thanks,
Jim

Message

From:	Nunez, Alejandra [Nunez.Alejandra@epa.gov]
Sent:	4/21/2021 1:02:32 AM
To:	Blubaugh, Jim [Blubaugh.Jim@epa.gov]
CC:	Goffman, Joseph [Goffman.Joseph@epa.gov]; Millett, John [Millett.John@epa.gov]; Dunham, Sarah [Dunham.Sarah@epa.gov]; Hengst, Benjamin [Hengst.Benjamin@epa.gov]; Birgfeld, Erin [Birgfeld.Erin@epa.gov]; Burch, Julia [Burch.Julia@epa.gov]; Mroz, Jessica [mroz.jessica@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]
Subject:	RE: Materials to support Administrator's participation in the Zero Emission Vehicle Transition Council Meeting Monday
Attachments:	ZEV Ministerial Taling Points for Admin Regan - DRAFT an.docx; EPA Administrator Briefing Memo_ZEV Transition Council an.docx

Thank you very much, Jim. Attached are a few edits to the briefing memo and talking points, for your consideration.

From: Blubaugh, Jim <Blubaugh.Jim@epa.gov>
Sent: Tuesday, April 20, 2021 8:11 PM
To: OAR Briefings <OAR_Briefings@epa.gov>
Cc: Millett, John <Millett.John@epa.gov>; Dunham, Sarah <Dunham.Sarah@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Birgfeld, Erin <Birgfeld.Erin@epa.gov>; Burch, Julia <Burch.Julia@epa.gov>; Mroz, Jessica <mroz.jessica@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>; OTAQ Materials <OTAQMaterials@epa.gov>
Subject: Materials to support Administrator's participation in the Zero Emission Vehicle Transition Council Meeting Monday

Dear OAR,

Attached you will find a series of documents to support Administrator Regan's upcoming meeting with the Zero Emission Vehicle Transition Council on Monday, April 26th. I have outlined each draft document below:

1) Administrator's Briefing Memo
2) Talking points for the Administrator's interventions during the meeting
3) Summary of EV-related information in the President's Jobs/Infrastructure Plan (to be used as an appendix to the memo)

I have also attached three documents as background to complete the package. The two presentations will be discussed during the ZEVTC meeting.

4) ZEVTC Meeting Agenda
5) CCC presentation
6) ICCT presentation

Joe, Ale – given the time crunch we are currently under, we are hoping for your quick review. Once you are comfortable with the materials we can work with John M. to get Maria the talking points, and Rosemary the briefing materials.

Thanks,
Jim

Jim Blubaugh, Director
International Policy
Office of Transportation and Air Quality

Office of Air and Radiation
U.S. Environmental Protection Agency

Message

From: Goffman, Joseph [Goffman.Joseph@epa.gov]
Sent: 4/21/2021 1:57:42 AM
To: Nunez, Alejandra [Nunez.Alejandra@epa.gov]; Blubaugh, Jim [Blubaugh.Jim@epa.gov]
CC: Millett, John [Millett.John@epa.gov]; Dunham, Sarah [Dunham.Sarah@epa.gov]; Hengst, Benjamin [Hengst.Benjamin@epa.gov]; Birgfeld, Erin [Birgfeld.Erin@epa.gov]; Burch, Julia [Burch.Julia@epa.gov]; Mroz, Jessica [mroz.jessica@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]
Subject: RE: Materials to support Administrator's participation in the Zero Emission Vehicle Transition Council Meeting Monday
Attachments: EPA Administrator Briefing Memo_ZEV Transition Council an jg.docx; ZEV Ministerial Taling Points for Admin Regan - DRAFT an jg.docx

My comment on top of Ale's. Thanks everyone for the great work.

Joseph Goffman
Acting Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency

From: Nunez, Alejandra <Nunez.Alejandra@epa.gov>
Sent: Tuesday, April 20, 2021 9:03 PM
To: Blubaugh, Jim <Blubaugh.Jim@epa.gov>
Cc: Goffman, Joseph <Goffman.Joseph@epa.gov>; Millett, John <Millett.John@epa.gov>; Dunham, Sarah <Dunham.Sarah@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Birgfeld, Erin <Birgfeld.Erin@epa.gov>; Burch, Julia <Burch.Julia@epa.gov>; Mroz, Jessica <mroz.jessica@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>
Subject: RE: Materials to support Administrator's participation in the Zero Emission Vehicle Transition Council Meeting Monday

Thank you very much, Jim. Attached are a few edits to the briefing memo and talking points, for your consideration.

From: Blubaugh, Jim <Blubaugh.Jim@epa.gov>
Sent: Tuesday, April 20, 2021 8:11 PM
To: OAR Briefings <OAR_Briefings@epa.gov>
Cc: Millett, John <Millett.John@epa.gov>; Dunham, Sarah <Dunham.Sarah@epa.gov>; Hengst, Benjamin <Hengst.Benjamin@epa.gov>; Birgfeld, Erin <Birgfeld.Erin@epa.gov>; Burch, Julia <Burch.Julia@epa.gov>; Mroz, Jessica <mroz.jessica@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>; OTAQ Materials <OTAQMaterials@epa.gov>
Subject: Materials to support Administrator's participation in the Zero Emission Vehicle Transition Council Meeting Monday

Dear OAR,

Attached you will find a series of documents to support Administrator Regan's upcoming meeting with the Zero Emission Vehicle Transition Council on Monday, April 26th. I have outlined each draft document below:

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6) ICCT presentation

Joe, Ale – given the time crunch we are currently under, we are hoping for your quick review. Once you are comfortable with the materials we can work with John M. to get Maria the talking points, and Rosemary the briefing materials.

Thanks,
Jim

Jim Blubaugh, Director
International Policy
Office of Transportation and Air Quality
Office of Air and Radiation
U.S. Environmental Protection Agency

Message

From: Blubaugh, Jim [Blubaugh.Jim@epa.gov]
Sent: 4/28/2021 8:31:46 PM
To: Charmley, William [charmley.william@epa.gov]
CC: Olechiw, Michael [olechiw.michael@epa.gov]; Wysor, Tad [wysor.tad@epa.gov]; Moran, Robin [moran.robin@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]
Subject: RE: International ZEV Transition Council
Attachments: EPA Administrator Briefing Memo_ZEVTC_final.docx; ZEV Ministerial Talking Points for Admin Regan.docx; Final Agenda - ZEVTC 260421.pdf; CCC_ZEVTC_Ministerial_Slides.pdf; ICCT_LCA study April2021.pdf; 201021 ZEV Transition Council concept note.docx; First ZEVTC Meeting - Official Summary v 0 1.docx

Bill,

I wanted to circle back on my commitment to share material from the recent International ZEV Transition Council meeting. I have attached several documents that I hope will help folks get a better idea of what this Ministerial-level Council is all about.

Administrator Prep Docs
1) Briefing Memo
2) Talking Points

ZEV Transition Council Info
3) Meeting Agenda
4) CCC Presentation during the meeting
5) ICCT Presentation during the meeting
6) Council Concept note – background
7) First ZEVTC Meeting readout

I am still waiting for the official readout for the Monday meeting from my colleagues in the U.K. Let me know if you have any questions.

Thanks,
Jim

From: Blubaugh, Jim
Sent: Wednesday, April 21, 2021 8:36 AM
To: Charmley, William <charmley.william@epa.gov>
Cc: Olechiw, Michael <olechiw.michael@epa.gov>; Wysor, Tad <wysor.tad@epa.gov>; Moran, Robin <moran.robin@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>
Subject: RE: International ZEV Transition Council

Yes and yes I will definitely share the material we are preparing for the Administrator.

-Jim

From: Charmley, William <charmley.william@epa.gov>
Sent: Wednesday, April 21, 2021 8:31 AM
To: Blubaugh, Jim <Blubaugh.Jim@epa.gov>
Cc: Olechiw, Michael <olechiw.michael@epa.gov>; Wysor, Tad <wysor.tad@epa.gov>; Moran, Robin

<moran.robin@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>
Subject: RE: International ZEV Transition Council

Jim,

Did Administrator Regan decide to participate on this International ZEV Transition Council meeting today to represent the Biden Administration? If yes, and when it's done, can you track down from OITA any prep. material that was provided to the Administrator?

Thanks
Bill

From: Blubaugh, Jim <Blubaugh.Jim@epa.gov>
Sent: Tuesday, April 20, 2021 4:31 PM
To: Charmley, William <charmley.william@epa.gov>; Moran, Robin <moran.robin@epa.gov>
Cc: Olechiw, Michael <olechiw.michael@epa.gov>; Wysor, Tad <wysor.tad@epa.gov>
Subject: International ZEV Transition Council

Hi everyone,

Update on the ZEV Transition Council: The WH recommended that EPA represent the U.S. here. This morning the Administrator accepted the U.K.'s invitation (attached) to participate on this Council. There is actually a virtual Ministerial meeting coming up on Monday, April 26th in which he plans to attend.

I am currently working on briefing materials, etc... along with ErinB and OITA. Stay tuned!

Thanks,
Jim

From: Blubaugh, Jim
Sent: Tuesday, April 06, 2021 3:18 PM
To: Charmley, William <charmley.william@epa.gov>; Moran, Robin <moran.robin@epa.gov>
Cc: Olechiw, Michael <olechiw.michael@epa.gov>; Wysor, Tad <wysor.tad@epa.gov>
Subject: RE: ICCT ZEV Alliance Webinars - Supporting jurisdictions w/ 100% ZEV targets

Yes, vaguely though. I remember hearing from ICCT several years ago (2015?) about starting something in the U.S. to promote ZEV adoption, etc.... I think the Alliance is actually that. Its members are mostly states in the U.S. as it started out. But then they added some Canadian provinces and I think even Germany and perhaps the U.K. are members.

But, this is different from the ZEV Transition Council that we heard about from ICCT the other day. The ZEZ Transition Council was founded this past Fall by the U.K. as they are now the President of the G7 and hosts of this year's COP. The Council is actually at the Ministerial level with a working group to be at our levelish. ICCT is the secretariat for the Council. Many of the large auto-producing and using nations are members of the Council.

The U.K. briefed the WH a few weeks ago (I sat in on it) and invited the U.S. to join. The WH response, at that time, was that we are very interested in the objectives of the Council as they dove-tail nicely with what President Biden is pushing for regarding ZEVs. However the U.S. is still confirming agency leaders and sorting out this Administration's goals in this field.....so the bottom line there is that WE will get back to you. And, as far as I know it, that is where it stands. FYI, Austin Brown (CEQ) and I were just invited to attend a yet to be schedule on the Council to occur in the coming weeks.

Hope that info helps.

Jim

From: Charmley, William <charmley.william@epa.gov>
Sent: Tuesday, April 06, 2021 2:13 PM
To: Moran, Robin <moran.robin@epa.gov>; Blubaugh, Jim <Blubaugh.Jim@epa.gov>
Cc: Olechiw, Michael <olechiw.michael@epa.gov>; Wysor, Tad <wysor.tad@epa.gov>
Subject: RE: ICCT ZEV Alliance Webinars - Supporting jurisdictions w/ 100% ZEV targets

Robin,

Thanks for sending this to me. I don't think I have heard of this particular ICCT initiative, the ZEV Alliance.

Jim – does this ring a bell with you?

Thanks
Bill

From: Moran, Robin <moran.robin@epa.gov>
Sent: Tuesday, April 06, 2021 11:36 AM
To: Charmley, William <charmley.william@epa.gov>
Cc: Olechiw, Michael <olechiw.michael@epa.gov>; Wysor, Tad <wysor.tad@epa.gov>
Subject: FW: ICCT ZEV Alliance Webinars - Supporting jurisdictions w/ 100% ZEV targets

Bill,

Our Region 9 workgroup rep, John Mikulin, sent around an invite from ICCT for a "government-only" webinar series aimed at supporting states/local govts with 100% ZEV mandates. I saw that you recently had a call w/Drew and just curious if he raised this topic, or whether you've otherwise heard about it.

I haven't yet sent this out to the team to see if someone might be interested in participating, but could see it perhaps being useful info for the long-term rule.

Robin

From: Mikulin, John <MIKULIN.JOHN@EPA.GOV>
Sent: Thursday, April 01, 2021 9:53 AM
To: Moran, Robin <moran.robin@epa.gov>; Wysor, Tad <wysor.tad@epa.gov>; Cherry, Jeff <Cherry.Jeff@epa.gov>; Burke, Susan <Burke.Susan@epa.gov>; Daniels, Jessica <daniels.jessica@epa.gov>; Ramig, Christopher <Ramig.Christopher@epa.gov>
Subject: FW: ICCT ZEV Alliance Webinars - Supporting jurisdictions w/ 100% ZEV targets

FYI, below & attached. Feel free to share within OTAQ. Apologies if duplicate.

Register - https://attendee.gotowebinar.com/register/7047628055316860685

From: Anaisa PINTO <apinto@theclimategroup.org>
Sent: Thursday, April 1, 2021 5:00 AM
Cc: Alice RYAN <aryan@theclimategroup.org>; Peter Slowik <peter.slowik@theicct.org>

Subject: ZEV Community: invitation to participate in ZEV Alliance virtual workshop focused on supporting jurisdictions with 100% ZEV targets

Dear ZEV Community friends,

We thought you might be interested in an upcoming virtual workshop from the ZEV Alliance, focused on supporting jurisdictions with 100% ZEV targets.

The ICCT will administer on behalf of the ZEV Alliance a 4-part government-only virtual workshop series focused on different aspects of setting and achieving 100% ZEV targets. The series will take place over the April-June timeframe, and participation is limited to governments and invite-only, starting with the ZEV Community. Key topics and dates include (*all times 15:00 UTC*):

1. April 21: *The state of the global transition to 100% ZEVs*
2. May 5: *Creating strong, binding 100% ZEV policies*
3. May 19: *Working with cities to achieve 100% ZEV targets*
4. June 2: *Economic and industrial effects of a 100% ZEV transition*

More information and a registration link is included in the attached invitation. Please do not circulate the invitation beyond your governments. If you know of any other governments who may be interested, please reach out to us and we can invite them directly.

Kind regards,
Anaísa

Anaísa Pinto
Senior Project Officer, Under2 Coalition – ZEV Community

apinto@theclimategroup.org

The Climate Group
Correspondence address: Adam House, 7-10 Adam Street, London, WC2N 6AA, United Kingdom
t: +44 (0)20 7960 2970 e: info@theclimategroup.org

TheClimateGroup.org

Message

From: Snapp, Lisa [snapp.lisa@epa.gov]
Sent: 5/11/2018 9:02:02 PM
To: Simon, Karl [Simon.Karl@epa.gov]
CC: Burke, Susan [Burke.Susan@epa.gov]; McCubbin, Courtney [McCubbin.Courtney@epa.gov]
Subject: draft MSTRS slides
Attachments: Karl MSTRS Future Mobility May 2018.pptx

Hi Karl—

Here's start at some quiz/survey slides for the MSTRS crowd. Let me know what you like, and I can refine accordingly. I expect this will generate some new ideas –happy to add those as well.

FYI, there will be no one from the Ann Arbor CASC crowd in the office next week. I'll take this with me and can work on it from Davis, and will also leave it with the DC crew. Susan is acting.

I am lined up to call you Monday at 8:30 to discuss, but learned that I need to head out the door at 8:35 to catch my bus to the airport. Let me know if I should call you earlier, or try find another time—Monday evening when I get to Davis, or in between sessions on Tuesday, perhaps? Or time-shifted conversations through voicemail can work.

Thanks,
--Lisa

Driving Innovation in Clean Transportation

Message

From: Burke, Susan [Burke.Susan@epa.gov]
Sent: 6/28/2021 6:18:14 PM
To: Simon, Karl [Simon.Karl@epa.gov]
CC: Moltzen, Michael [Moltzen.Michael@epa.gov]; McCoy, Britney [McCoy.Britney@epa.gov]; Koester, Christine [koester.christine@epa.gov]
Subject: VW Settlement Briefing Materials
Attachments: VW Settlement Briefing 6.29.21.pptx

Hi Karl,

Revised slides are attached. Let us know if you'd like any additional edits.

Per below, final slides should be sent to Shanita Loving <Loving.Shanita@epa.gov> in OECA with Meetu copied by 3 pm. I'm happy to send them forward once you think they are ready.

Susan

From: Kaul, Meetu <Kaul.Meetu@epa.gov>
Sent: Monday, June 28, 2021 9:19 AM
To: Loving, Shanita <Loving.Shanita@epa.gov>
Cc: Burke, Susan <Burke.Susan@epa.gov>
Subject: RE: Briefing Materials for tomorrow's "VW Settlement Briefing" with Larry

Hi Shanita,

OAR's Office of Transportation and Air Quality is leading the briefing.

Susan can you provide the final materials to Shanita by 3:00pm today (and copy me so I can pass them up as well)?

Thanks,
mk

Ms. Meetu Kaul, Chief
Vehicle and Engine Enforcement Branch
United States Environmental Protection Agency
Direct: 202-564-5472
Email: kaul.meetu@epa.gov

Message

From: Burke, Susan [Burke.Susan@epa.gov]
Sent: 6/24/2021 4:53:30 PM
To: Simon, Karl [Simon.Karl@epa.gov]
CC: Koester, Christine [koester.christine@epa.gov]
Subject: Draft slides for June 29th VW Settlement Briefing
Attachments: DRAFT VW Settlement Briefing 6.29.21.pptx

Hi Karl,

I incorporated the edits we discussed in the attached version.

Thanks,
Susan

From: Burke, Susan
Sent: Thursday, June 24, 2021 10:26 AM
To: Simon, Karl <Simon.Karl@epa.gov>; Belser, Evan <Belser.Evan@epa.gov>
Cc: Kaul, Meetu <Kaul.Meetu@epa.gov>; Moltzen, Michael <Moltzen.Michael@epa.gov>; Snapp, Lisa <snapp.lisa@epa.gov>; Koester, Christine <koester.christine@epa.gov>; McCoy, Britney <McCoy.Britney@epa.gov>
Subject: Draft slides for June 29th VW Settlement Briefing

Hi Karl and Evan,

Attached for review are draft slides for the VW Settlement briefing with Lawrence Starfield and Joe Goffman next Tuesday. Please let us know if you'd like any edits or additions.

Thanks,
Susan

Susan Burke, Ph.D.
Scientist (pronouns: she/her/hers)
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
(202) 343-9098

Message

From: Burke, Susan [Burke.Susan@epa.gov]
Sent: 5/16/2018 9:58:45 PM
To: Simon, Karl [Simon.Karl@epa.gov]
CC: Snapp, Lisa [snapp.lisa@epa.gov]; Daniels, Jessica [daniels.jessica@epa.gov]
Subject: FW: draft MSTRS slides
Attachments: Karl MSTRS Future Mobility May 2018.pptx

Hi Karl,

Jessica and I added a few upfront slides to frame future mobility (slides 4–9). Is this what you had in mind?

There are still some blanks and placeholders in the slides for graphics that we can complete by the end of the week. Please let us know if you have additional edits.

Thanks,
Susan

From: Snapp, Lisa
Sent: Friday, May 11, 2018 5:02 PM
To: Simon, Karl <Simon.Karl@epa.gov>
Cc: Burke, Susan <Burke.Susan@epa.gov>; McCubbin, Courtney <McCubbin.Courtney@epa.gov>
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Thanks,
--Lisa

Driving Innovation in Clean Transportation

Appointment

From: Atkinson, Emily [Atkinson.Emily@epa.gov]
Sent: 6/1/2018 6:14:21 PM
To: Charmley, William [charmley.william@epa.gov]; Grundler, Christopher [grundler.christopher@epa.gov]; Hengst, Benjamin [Hengst.Benjamin@epa.gov]; Gunasekara, Mandy [Gunasekara.Mandy@epa.gov]
CC: Moran, Robin [moran.robin@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]

Subject: Meet with Ceres Members (Confirmed)
Attachments: RE: Meeting request with Bill Wehrum ; Confirmed 6/4 at 10:15am: Meeting request with Bill Wehrum ; RE: Confirmed 6/4 at 10:15am: Meeting request with Bill Wehrum
Location: WJC-N 5400 + Video with AA + Dial: Ex. 6 Personal Privacy (PP)

Start: 6/4/2018 2:15:00 PM
End: 6/4/2018 3:00:00 PM
Show Time As: Tentative

Required Attendees: Charmley, William; Grundler, Christopher; Hengst, Benjamin; Gunasekara, Mandy
Optional Attendees: Moran, Robin; Olechiw, Michael; Simon, Karl

To: Bill Wehrum, Mandy Gunasekara, Chris Grundler, Ben Hengst, Mandy Gunasekara
Outside Attendees (in person): Christina Herman, Interfaith Center on Corporate Responsibility

- Matt Miller, Edison International
- Michael Garland, NYC Comptroller
- Ken Locklin, Impax
- Rob Fohr, Presbyterian Church
- Tess Hetzel Symantec Corporation
- Rohan Patel or Joe Mendelson, Tesla
- Kristina Friedman or Stuart Dalheim, Calvert
- Gretchen Zeagler, CalPERS
- Laurie Holmes, Motor and Equipment Manufacturers Association
- Mary Beth Gallagher, Tri-State Coalition for Responsible Investor
- Carol Lee Rawn, Ceres
- Ryan Martel, Ceres
- Anne Kelly, Ceres
- Cliff Rothenstein, K&L Gates
- Laurie Purpuro, K&L Gates

RE: Meeting request with Bill ... | Confirmed 6/4 at 10:15am: Meetin... | RE: Confirmed 6/4 at 10:15am: Mee...

Message

From: Lewis, Josh [Lewis.Josh@epa.gov]
Sent: 5/31/2018 3:49:51 PM
To: Rothenstein, Cliff L. [Cliff.Rothenstein@klgates.com]; Atkinson, Emily [Atkinson.Emily@epa.gov]
CC: Rakosnik, Delaney [rakosnik.delaney@epa.gov]
Subject: RE: Meeting request with Bill Wehrum

Yes, Bill will be available. We'll be in touch later today with a proposed time.

Josh

From: Rothenstein, Cliff L. [mailto:Cliff.Rothenstein@klgates.com]
Sent: Thursday, May 31, 2018 9:29 AM
To: Lewis, Josh <Lewis.Josh@epa.gov>; Atkinson, Emily <Atkinson.Emily@epa.gov>
Subject: RE: Meeting request with Bill Wehrum

Hi Josh,

I just wanted to check back to see if you had a chance to discuss our meeting request with Bill and if he will be available to meet with us next week.

Cliff

From: Lewis, Josh [mailto:Lewis.Josh@epa.gov]
Sent: Tuesday, May 29, 2018 4:19 PM
To: Rothenstein, Cliff L.; Atkinson, Emily
Subject: RE: Meeting request with Bill Wehrum

Hi Cliff,

Good to hear from you. We'll flag this for Bill tomorrow and be in touch.

Josh Lewis
Chief of Staff
EPA/Office of Air and Radiation
Office: 202 564 2095
Cell: 202 329 2291

From: Rothenstein, Cliff L. [mailto:Cliff.Rothenstein@klgates.com]
Sent: Tuesday, May 29, 2018 3:35 PM
To: Atkinson, Emily <Atkinson.Emily@epa.gov>
Cc: Lewis, Josh <Lewis.Josh@epa.gov>
Subject: Meeting request with Bill Wehrum

Hi Emily,

I'm hoping you can help me out on a meeting request with Bill Wehrum.

I represent Ceres - an organization of corporations and investors concerned about the impact changes in weather and climate are having on the economy. Ceres member companies will be in Washington, DC on June 4-5 and would like to talk to you about proposed changes to the vehicle emissions standards. Companies who would join the meeting include:

Mark Bescher, Unilever
Tess Hetzel, Symantec Corp
Ken Locklin, Impax Asset Management
Kristina Friedman, Stu Dalheim, Calvert
Amy Pressler, Southern CA Edison
Rohan Patel, Tesla
John Chaimanis, Kendall Investments
Brian Rice, CalSTRS
Michael Garland, NYC Assistant Comptroller

Please let me know if I can provide additional information. If you need to reach me by phone please call 240-778-3247.

Thank you.

Cliff

Sent from my iPhone

This electronic message contains information from the law firm of K&L Gates LLP. The contents may be privileged and confidential and are intended for the use of the intended addressee(s) only. If you are not an intended addressee, note that any disclosure, copying, distribution, or use of the contents of this message is prohibited. If you have received this e-mail in error, please contact me at Cliff.Rothenstein@klgates.com.

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Message

From: Atkinson, Emily [Atkinson.Emily@epa.gov]
Sent: 5/31/2018 7:41:05 PM
To: Rothenstein, Cliff L. [Cliff.Rothenstein@klgates.com]
CC: Rakosnik, Delaney [rakosnik.delaney@epa.gov]; Lewis, Josh [Lewis.Josh@epa.gov]
Subject: Confirmed 6/4 at 10:15am: Meeting request with Bill Wehrum

Hi Cliff,
You are confirmed for a 45 minute meeting on Monday, June 4 at 10:15am with Bill Wehrum and Mandy Gunasekara.
Directions and procedures to 1200 Pennsylvania Avenue NW:

Metro: If you come by Metro get off at the Federal Triangle metro stop. Exit the metro station and go up two sets of escalators to the surface level and turn right. You will see a short staircase and wheelchair ramp leading to a set of glass doors with the EPA logo - that is the William Jefferson Clinton Federal Building, North Entrance.

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Upon arrival, let the guards know that you were instructed to call 202-564-7404 for a security escort.
Please send me a list of participants in advance of the meeting and feel free to contact me should you need any additional information.

Emily

Emily Atkinson
Management Analyst/Office Manager
Immediate Office of the Assistant Administrator
Office of Air and Radiation, USEPA
Room 5412B, 1200 Pennsylvania Avenue NW
Washington, DC 20460
Voice: 202-564-1850
Email: atkinson.emily@epa.gov

From: Rothenstein, Cliff L. [mailto:Cliff.Rothenstein@klgates.com]
Sent: Thursday, May 31, 2018 3:39 PM
To: Atkinson, Emily <Atkinson.Emily@epa.gov>
Cc: Rakosnik, Delaney <rakosnik.delaney@epa.gov>; Lewis, Josh <Lewis.Josh@epa.gov>
Subject: Re: Meeting request with Bill Wehrum

Hi Emily,

Monday, June 4 at 10:15 works for us. Thank you for finding a time that works for Bill and please let me know if you need anything else.

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Sent from my iPhone

On May 31, 2018, at 3:31 PM, Atkinson, Emily <Atkinson.Emily@epa.gov> wrote:

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Emily

Emily Atkinson
Management Analyst/Office Manager
Immediate Office of the Assistant Administrator
Office of Air and Radiation, USEPA
Room 5412B, 1200 Pennsylvania Avenue NW
Washington, DC 20460
Voice: 202-564-1850
Email: atkinson.emily@epa.gov

From: Lewis, Josh
Sent: Thursday, May 31, 2018 11:50 AM
To: Rothenstein, Cliff L. <Cliff.Rothenstein@klgates.com>; Atkinson, Emily <Atkinson.Emily@epa.gov>
Cc: Rakosnik, Delaney <rakosnik.delaney@epa.gov>
Subject: RE: Meeting request with Bill Wehrum

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To: Rothenstein, Cliff L.; Atkinson, Emily
Subject: RE: Meeting request with Bill Wehrum

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Office: 202 564 2095
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Thank you.

Cliff

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Message

From:	Rothenstein, Cliff L. [Cliff.Rothenstein@klgates.com]
Sent:	6/1/2018 6:08:12 PM
To:	Atkinson, Emily [Atkinson.Emily@epa.gov]
CC:	Rakosnik, Delaney [rakosnik.delaney@epa.gov]; Lewis, Josh [Lewis.Josh@epa.gov]
Subject:	RE: Confirmed 6/4 at 10:15am: Meeting request with Bill Wehrum

Hi Emily, below is a list of the participants. I'm assuming that I should call you when I get to the lobby.

Cliff

Christina Herman, Interfaith Center on Corporate Responsibility
Matt Miller, Edison International
Michael Garland, NYC Comptroller
Ken Locklin, Impax
Rob Fohr, Presbyterian Church
Tess Hetzel Symantec Corporation
Rohan Patel or Joe Mendelson, Tesla
Kristina Friedman or Stuart Dalheim, Calvert
Gretchen Zeagler, CalPERS
Laurie Holmes, Motor and Equipment Manufacturers Association
Mary Beth Gallagher, Tri-State Coalition for Responsible Investor
Carol Lee Rawn, Ceres
Ryan Martel, Ceres
Anne Kelly, Ceres
Cliff Rothenstein, K&L Gates
Laurie Purpuro, K&L Gates

From: Atkinson, Emily [mailto:Atkinson.Emily@epa.gov]
Sent: Thursday, May 31, 2018 3:41 PM
To: Rothenstein, Cliff L.
Cc: Rakosnik, Delaney; Lewis, Josh
Subject: Confirmed 6/4 at 10:15am: Meeting request with Bill Wehrum

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Chief of Staff
EPA/Office of Air and Radiation
Office: 202 564 2095
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Rohan Patel, Tesla
John Chaimanis, Kendall Investments
Brian Rice, CalSTRS
Michael Garland, NYC Assistant Comptroller

Please let me know if I can provide additional information. If you need to reach me by phone please call 240-778-3247.

Thank you.

Cliff

Sent from my iPhone

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Message

From: Charmley, William [charmley.william@epa.gov]
Sent: 9/14/2021 6:55:07 PM
To: OTAQ Materials [OTAQMaterials@epa.gov]
CC: Moran, Robin [moran.robin@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Wysor, Tad [wysor.tad@epa.gov]; Miller, Elizabeth [Miller.Elizabeth@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]
Subject: Highlights from the LDV public hearing
Attachments: LDV Hearing Highlights_draft 9-14-2021.pptx

Dear Sarah,

The attached is largely an fyi for you. Within a few days after the public hearing in August the LDV near-term rule team developed the attached summary of the messages we heard from the various testifiers at the 2-day public hearing. It took me more time than it should have to review the document, which I have now done.

This is a quick read, and will give you a good impression of some of the high level messages. Of course, it is only for those stakeholders who decided to testify, and the testifiers only had 3 minutes.

We can also shared this with Ale Nunez, or Ale + Joe, if you think either of those would be helpful.

Thanks
Bill

Message

From: Moran, Robin [moran.robin@epa.gov]
Sent: 9/30/2021 1:58:03 PM
To: OTAQ Materials [OTAQMaterials@epa.gov]
CC: Charmley, William [charmley.william@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Dickinson, David [Dickinson.David@epa.gov]; Wysor, Tad [wysor.tad@epa.gov]; Miller, Elizabeth [Miller.Elizabeth@epa.gov]; Sherwood, Todd [sherwood.todd@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Orlin, David [Orlin.David@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]; Buchsbaum, Seth [buchsbaum.seth@epa.gov]; Okoye, Winifred [Okoye.Winifred@epa.gov]; Lieske, Christopher [lieske.christopher@epa.gov]
Subject: Materials for 11am LDV Update
Attachments: LDV FRM Alternatives Analysis_with Sarah_09-30-2021.pptx

Sarah and all,

Attached is the material we'll present at our 11am on the LDV final rule alternatives analysis, preliminary results thus far.

Robin

From: Moran, Robin
Sent: Wednesday, September 29, 2021 4:17 PM
To: OTAQ Materials <OTAQMaterials@epa.gov>
Cc: Charmley, William <charmley.william@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>; Olechiw, Michael <olechiw.michael@epa.gov>; Dickinson, David <Dickinson.David@epa.gov>; Tad Wysor <Wysor.Tad@epa.gov>; Miller, Elizabeth <Miller.Elizabeth@epa.gov>; Sherwood, Todd <sherwood.todd@epa.gov>; Bolon, Kevin <Bolon.Kevin@epa.gov>; Orlin, David <Orlin.David@epa.gov>; Kataoka, Mark <Kataoka.Mark@epa.gov>; Buchsbaum, Seth <buchsbaum.seth@epa.gov>; Okoye, Winifred <Okoye.Winifred@epa.gov>; Lieske, Christopher <lieske.christopher@epa.gov>
Subject: Agenda for Thursday's Light-Duty Weekly (11am)

Sarah,

Here is our Agenda for the LDV weekly tomorrow:

- California Waiver update
- LDV Final Rule Alternatives – preliminary modeling results

For the LDV modeling results, as you know this is moving incredibly fast and thus we are still working on materials, and will provide those tomorrow morning.

Thanks,
Robin

Robin Moran (she/her)
Senior Policy Advisor
U.S. EPA, Office of Transportation and Air Quality
2000 Traverwood Dr.

Ann Arbor, MI 48105
(734) 214-4781

Message

From: Moran, Robin [moran.robin@epa.gov]
Sent: 9/30/2021 8:11:55 PM
To: OAR Briefings [OAR_Briefings@epa.gov]
CC: OTAQ Materials [OTAQMaterials@epa.gov]; Charmley, William [charmley.william@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Dickinson, David [Dickinson.David@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Sherwood, Todd [sherwood.todd@epa.gov]; Miller, Elizabeth [Miller.Elizabeth@epa.gov]; Orlin, David [Orlin.David@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]; Buchsbaum, Seth [buchsbaum.seth@epa.gov]; Okoye, Winifred [Okoye.Winifred@epa.gov]
Subject: Material for Friday's Light-Duty Vehicles Update
Attachments: LDV FRM Alternatives Analysis_with OAR_10-01-2021.pptx

Dear OAR,

Here is the material we will discuss during our LDV update tomorrow at 12 noon. This is our preliminary analysis of Alternatives for the LDV final rule.

Thanks
Robin

Robin Moran (she/her)
Senior Policy Advisor
U.S. EPA, Office of Transportation and Air Quality
2000 Traverwood Dr.
Ann Arbor, MI 48105
(734) 214-4781

Message

From: Moran, Robin [moran.robin@epa.gov]
Sent: 10/5/2021 7:49:10 PM
To: OAR Briefings [OAR_Briefings@epa.gov]
CC: OTAQ Materials [OTAQMaterials@epa.gov]; Charmley, William [charmley.william@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Wysor, Tad [wysor.tad@epa.gov]; Miller, Elizabeth [Miller.Elizabeth@epa.gov]; Sherwood, Todd [sherwood.todd@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Srinivasan, Gautam [Srinivasan.Gautam@epa.gov]; Orlin, David [Orlin.David@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]; Buchsbaum, Seth [buchsbaum.seth@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]
Subject: Material for Wednesday (10/6) 3pm Pre-brief on LDV Options Selection
Attachments: Light-Duty Vehicle GHG Standards FRM Options Selection Mtg_with OAR 10-6-2021.pptx

Dear OAR,

Attached is the material for our pre-brief with you tomorrow on the Light-duty Vehicle GHG Options Selection meeting.

Robin

Robin Moran (she/her)
Senior Policy Advisor
U.S. EPA, Office of Transportation and Air Quality
2000 Traverwood Dr.
Ann Arbor, MI 48105
(734) 214-4781

Message

From: Moran, Robin [moran.robin@epa.gov]
Sent: 10/5/2021 1:46:18 PM
To: OTAQ Materials [OTAQMaterials@epa.gov]
CC: Charmley, William [charmley.william@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Dickinson, David [Dickinson.David@epa.gov]; Sherwood, Todd [sherwood.todd@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Wysor, Tad [wysor.tad@epa.gov]; Miller, Elizabeth [Miller.Elizabeth@epa.gov]; Lieske, Christopher [lieske.christopher@epa.gov]; Orlin, David [Orlin.David@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]; Buchsbaum, Seth [buchsbaum.seth@epa.gov]; Okoye, Winifred [Okoye.Winifred@epa.gov]
Subject: Material for 10am Light-duty Update
Attachments: Light-Duty Vehicle GHG Standards FRM Options Selection Mtg_with Sarah 10-5-21.pptx

Sarah,

Attached is the draft Options Selection briefing that we will discuss at our 10am LDV update.

Robin

From: Moran, Robin
Sent: Monday, October 04, 2021 4:09 PM
To: OTAQ Materials <OTAQMaterials@epa.gov>
Cc: Charmley, William <charmley.william@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>; Olechiw, Michael <olechiw.michael@epa.gov>; Dickinson, David <Dickinson.David@epa.gov>; Sherwood, Todd <sherwood.todd@epa.gov>; Bolon, Kevin <Bolon.Kevin@epa.gov>; Tad Wysor <Wysor.Tad@epa.gov>; Miller, Elizabeth <Miller.Elizabeth@epa.gov>; Lieske, Christopher <lieske.christopher@epa.gov>; Orlin, David <Orlin.David@epa.gov>; Kataoka, Mark <Kataoka.Mark@epa.gov>; Buchsbaum, Seth <buchsbaum.seth@epa.gov>; Okoye, Winifred <Okoye.Winifred@epa.gov>
Subject: Agenda for Tuesday's 10am Light-duty Update

Sarah,

Below is our Agenda for the LDV weekly at 10am tomorrow. Under our 1st item below, we would like to review with you the draft Options Selection briefing, but we are still working on new modeling runs to incorporate an additional Alternative into the mix, so will share the draft tomorrow morning.

<u>Agenda</u>

- Options Selection [draft briefing will be sent Tuesday morning]
- Wed 10/6 3pm: OTAQ pre-brief w/OAR
- Thurs 10/7 4pm: Workgroup pre-brief w/OAR & WG AA/RAs
-
- OAR meeting with Environmental NGOs on Thursday, 10/7
- Pre-brief with OAR on Wed 10/6: draft 2-pager on USC/NRDC comments and OTAQ technical engagement (sent to OTAQ Materials this morning)

- EPA review of NHTSA EIS - AA-level meeting cancelled; OP is drafting letter and will send soon for review

Robin Moran (she/her)
Senior Policy Advisor
U.S. EPA, Office of Transportation and Air Quality
2000 Traverwood Dr.
Ann Arbor, MI 48105
(734) 214-4781

Message

From: Lance, Kathleen [Lance.Kathleen@epa.gov]
Sent: 10/13/2021 7:23:38 PM
To: Utech, Dan [Utech.Dan@epa.gov]; Cassady, Alison [Cassady.Alison@epa.gov]; Lucey, John [Lucey.John.D@epa.gov]; Goffman, Joseph [Goffman.Joseph@epa.gov]; Nunez, Alejandra [Nunez.Alejandra@epa.gov]; Campbell, Ann [Campbell.Ann@epa.gov]; Kim, Eunjung [Kim.Eun@epa.gov]; Dunham, Sarah [Dunham.Sarah@epa.gov]; Hengst, Benjamin [Hengst.Benjamin@epa.gov]; Mroz, Jessica [mroz.jessica@epa.gov]; Burch, Julia [Burch.Julia@epa.gov]; Charmley, William [charmley.william@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Moran, Robin [moran.robin@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Wysor, Tad [wysor.tad@epa.gov]; Miller, Elizabeth [Miller.Elizabeth@epa.gov]; Werner, Christopher [Werner.Christopher@epa.gov]; Hoffer, Melissa [Hoffer.Melissa@epa.gov]; Prabhu, Aditi [Prabhu.Aditi@epa.gov]; Srinivasan, Gautam [Srinivasan.Gautam@epa.gov]; Orlin, David [Orlin.David@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]; Buchsbaum, Seth [buchsbaum.seth@epa.gov]; Arroyo, Victoria [Arroyo.Victoria@epa.gov]; Miles-McLean, Stuart [Miles-Mclean.Stuart@epa.gov]; Lamson, Amy [Lamson.Amy@epa.gov]; Nagelhout, Peter [Nagelhout.Peter@epa.gov]; Cooperstein, Sharon [Cooperstein.Sharon@epa.gov]; Simon, Nathalie [Simon.Nathalie@epa.gov]; OP ADP Calendar [OP_ADP_Calendar@epa.gov]; Starfield, Lawrence [Starfield.Lawrence@epa.gov]; Bartlett, Keith [Bartlett.Keith@epa.gov]; Alexander, David [Alexander.David@epa.gov]; Belser, Evan [Belser.Evan@epa.gov]; Cascio, Wayne [Cascio.Wayne@epa.gov]; Benner, Tim [Benner.Tim@epa.gov]; Watkins, Stephen [watkins.stephen@epa.gov]; Ross, Mary [Ross.Mary@epa.gov]; Frey, Christopher [Frey.Christopher@epa.gov]; Szaro, Deb [Szaro.Deb@epa.gov]; Rogan, John [Rogan.John@epa.gov]; Wong, Shutsu [Wong.Shutsu@epa.gov]; Jordan, Deborah [Jordan.Deborah@epa.gov]; Mikulin, John [MIKULIN.JOHN@EPA.GOV]; Adams, Elizabeth [Adams.Elizabeth@epa.gov]; Lakin, Matt [Lakin.Matthew@epa.gov]; Machol, Ben [Machol.Ben@epa.gov]; McDaniel, Penelope [MCDANIEL.PENELOPE@EPA.GOV]; Aspy, Dale [Aspy.Dale@epa.gov]; Martin, Tina [martin.tina@epa.gov]; Blevins, John [Blevins.John@epa.gov]; Fine, Philip [Fine.Philip@epa.gov]; Efron, Brent [Efron.Brent@epa.gov]; Freeman, Caroline [Freeman.Caroline@epa.gov]; Monell, Carol [Monell.Carol@epa.gov]; Niebling, William [Niebling.William@epa.gov]
CC: McCabe, Janet [McCabe.Janet@epa.gov]; Morgan, Ashley [Morgan.Ashley.M@epa.gov]
Subject: RE: Video-call: Options Selection Meeting for Revised Light-Duty Vehicle GHG Emissions Standards FRM
Attachments: 2021 10 14 OAR Briefing Memo Options Selection for LDV GHG FRM - Briefing Memo.docx; 2021 10 14 OAR Decision Memo Options Selection for LDV GHG FRM - Decision Memo.docx; 2021 10 14 OAR Slide Deck Options Selection for LDV GHG FRM - Slides.pptx

Materials attached for tomorrow's 4:15PM.

-----Original Appointment-----
From: scheduling
Sent: Wednesday, September 22, 2021 12:47 PM
To: scheduling; Utech, Dan; Cassady, Alison; Lucey, John; Goffman, Joseph; Nunez, Alejandra; Campbell, Ann; Kim, Eunjung; Dunham, Sarah; Hengst, Benjamin; Mroz, Jessica; Burch, Julia; Charmley, William; Simon, Karl; Moran, Robin; Olechiw, Michael; Wysor, Tad; Miller, Elizabeth; Werner, Christopher; Hoffer, Melissa; Prabhu, Aditi; Srinivasan, Gautam; Orlin, David; Kataoka, Mark; Buchsbaum, Seth; Arroyo, Victoria; Miles-McLean, Stuart; Lamson, Amy; Nagelhout, Peter; Cooperstein, Sharon; Simon, Nathalie; OP ADP Calendar; Starfield, Lawrence; Bartlett, Keith; Alexander, David; Belser, Evan; Cascio, Wayne; Benner, Tim; Watkins, Stephen; Ross, Mary; Frey, Christopher; Szaro, Deb; Rogan, John; Wong, Shutsu; Jordan, Deborah; Mikulin, John; Adams, Elizabeth; Lakin, Matt; Machol, Ben; McDaniel, Penelope; Aspy, Dale; Martin, Tina; Blevins, John; Fine, Philip; Efron, Brent; Freeman, Caroline; Monell, Carol; Niebling, William
Cc: McCabe, Janet
Subject: Video-call: Options Selection Meeting for Revised Light-Duty Vehicle GHG Emissions Standards FRM
When: Thursday, October 14, 2021 4:15 PM-5:15 PM (UTC-05:00) Eastern Time (US & Canada).
Where: Microsoft Teams Meeting

Do not forward this invitation. Please notify Scheduling@epa.gov if participant changes need to be made.

-Administrator Regan
-Dan Utech

-Alison Cassady
-John Lucey
-DA Janet McCabe – Optional

Virtual:
-Joe Goffman, OAR
-Alejandra Nunez, OAR
-Ann Campbell, OAR
-Eunjung Kim, OAR
-Sarah Dunham, OAR
-Benjamin Hengst, OAR
-Jessie Mroz, OAR
-Julia Burch, OAR
-William Charmley, OAR
-Karl Simon, OAR
-Robin Moran, OAR
-Michael Olechiw, OAR
-Tad Wysor, OAR
-Elizabeth Miller, OAR
-Christopher Werner, OAR
-Melissa Hoffer, OGC
-Aditi Prabhu, OGC
-Gautam Srinivasan, OGC
-David Orlin, OGC
-Mark Kataoka, OGC
-Seth Buchsbaum, OGC
-Victoria Arroyo, OP
-Stuart Miles-McLean, OP
-Amy Lamson, OP
-Peter Nagelhout, OP
-Sharon Cooperstein, OP
-Nathalie Simon, OP
-OP ADP Calendar (OP_ADP_Calendar@epa.gov)
-Lawrence Starfield, OECA
-Keith Bartlett, OECA
-David Alexander, OECA
-Evan Belser, OECA
-Wayne Cascio, ORD
-Tim Benner, ORD
-Stephen Watkins, ORD
-Mary Ross, ORD
-Christopher Frey, ORD
-Deb Szaro, R01
-John Rogan, R01
-Shutsu Wong, R01
-Deborah Jordan, R09
-John Mikulin, R09
-Elizabeth Adams, R09
-Matt Lakin, R09
-Ben Machol, R09
-Penelope McDaniel, R09
-Dale Aspy, R04
-Tina Martin, R04

-John Blevins, R04
-Caroline Freeman, R4
-Carol Monell, R4
-Phil Fine, OP
-Brent Efron, OP
-William Niebling, OCIR

Microsoft Teams meeting

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Message

From: Burke, Susan [Burke.Susan@epa.gov]
Sent: 9/14/2021 2:07:09 AM
To: Simon, Karl [Simon.Karl@epa.gov]
CC: McCoy, Britney [McCoy.Britney@epa.gov]
Subject: Talk on EV landscape at TATD division mtg Thursday
Attachments: TATD Division Meeting Sept 16.pptx

Hi Karl,

As we mentioned a few weeks ago, Cay Yanca asked me to speak at the upcoming TATD Division meeting (Sept 16) about EVs and charging infrastructure. The talk is meant to be a broad overview of the EV landscape—market and policy. ASD will be following up in October with a talk about the upcoming rules and OTAQ work in this area.

Attached are draft slides. Most of these are updated versions of slides you've seen before, but I would appreciate any feedback you have on the messaging and content.

Thanks!
Susan

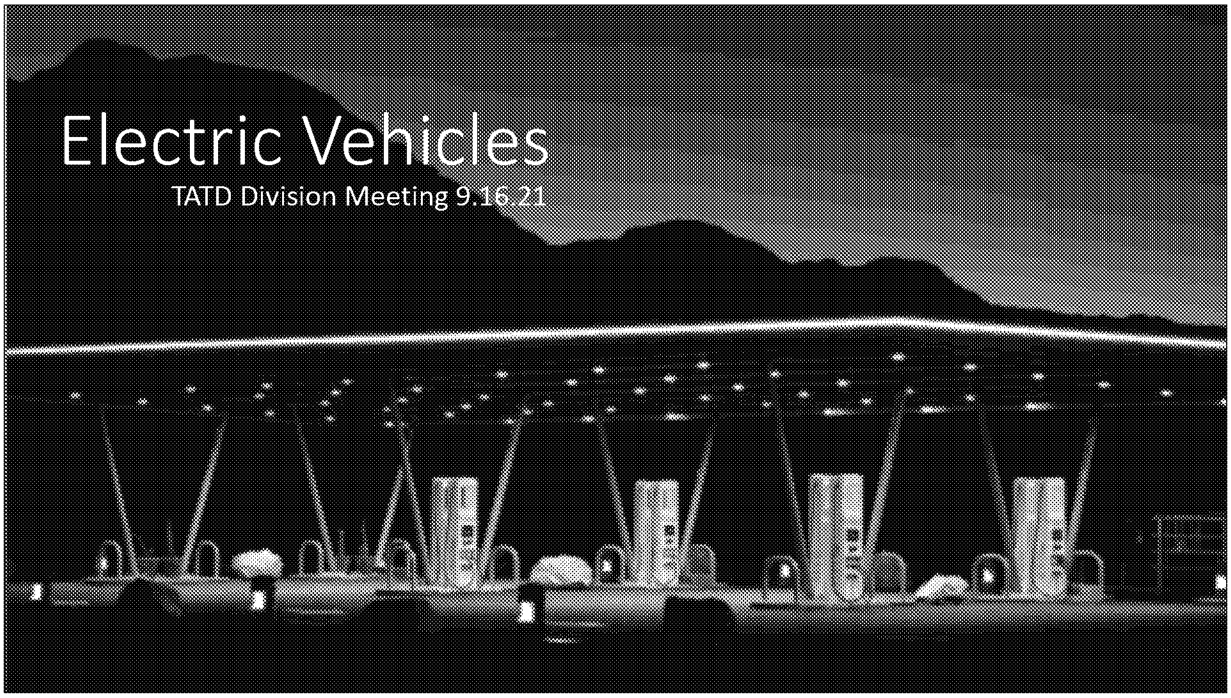
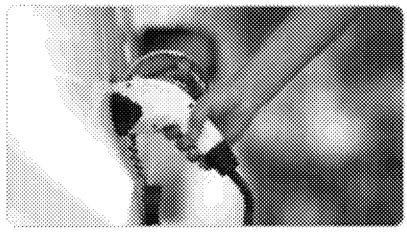


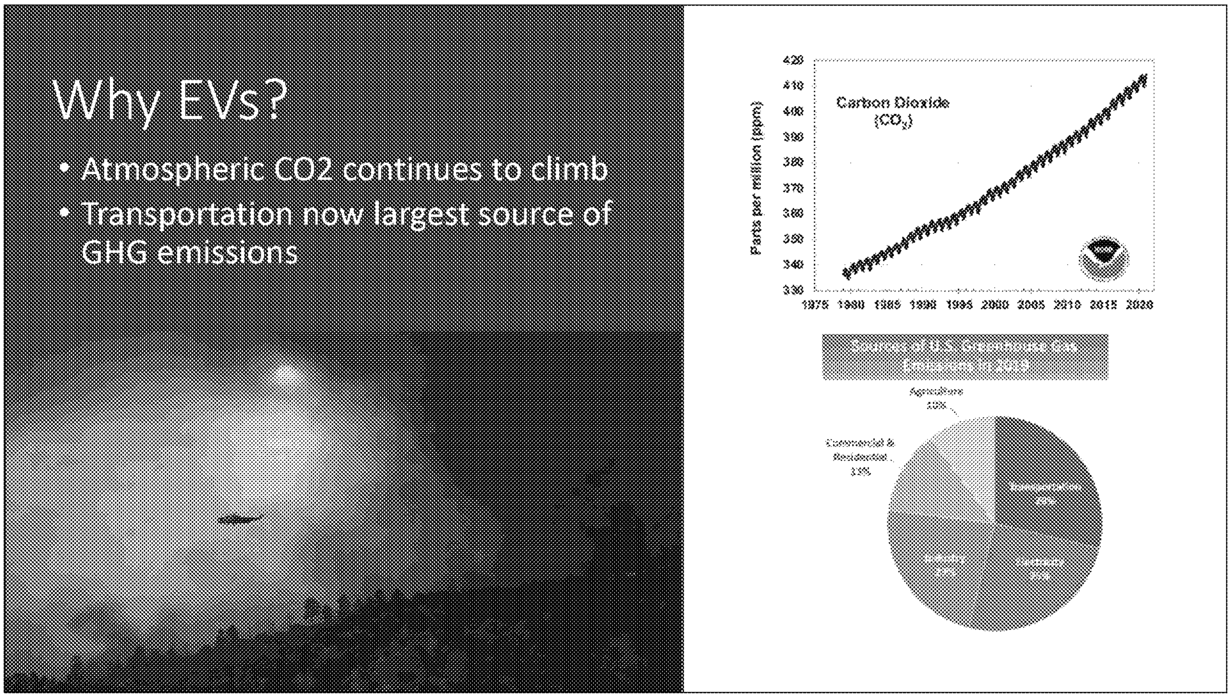
Image Source: Electrify America
Note: Slides for Internal Use only. Some images may have copyright restrictions. Check before sharing externally.

Overview

- Climate and Policy Context
- Electric Vehicles
  - Global & U.S. Market
  - Cost Considerations
  - Emissions
- Charging Infrastructure
  - Status of U.S. charging stations
  - How much will we need?



Sources:
Photos from fueleconomy.gov. Top photo shows 2019 Tesla Model 3.



Source: https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks
https://research.noaa.gov/article/ArtMID/587/ArticleID/2759/NOAA-index-tracks-how-greenhouse-gas-pollution-amplified-global-warming-in-2020 (Notes: These graphs depict the global average abundances of the major, well-mixed, long-lived greenhouse gases - carbon dioxide, methane, nitrous oxide, CFC-12 and CFC-11 - from the NOAA global air sampling network plotted since the beginning of 1979.)
https://www.noaa.gov/media-advisory/wildfire-season-and-fire-weather-resource-guide-for-reporters-and-media

Meeting new Executive Order targets will require steep increases in EV sales

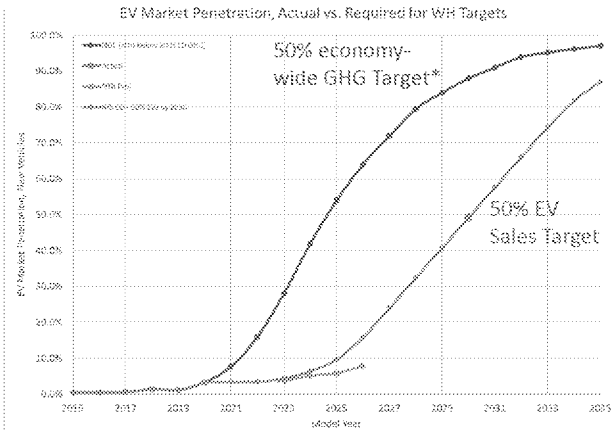
Executive Order on Tackling the Climate Crisis at Home and Abroad

JANUARY 27, 2021 • PRESIDENTIAL ACTIONS

- Jan EO put U.S. on a path to achieve net zero emissions, economy-wide by 2050

Executive Order on Strengthening American Leadership in Clean Cars and Trucks

- Aug EO set goal for 50% of new cars and trucks to be zero emission vehicles by 2030

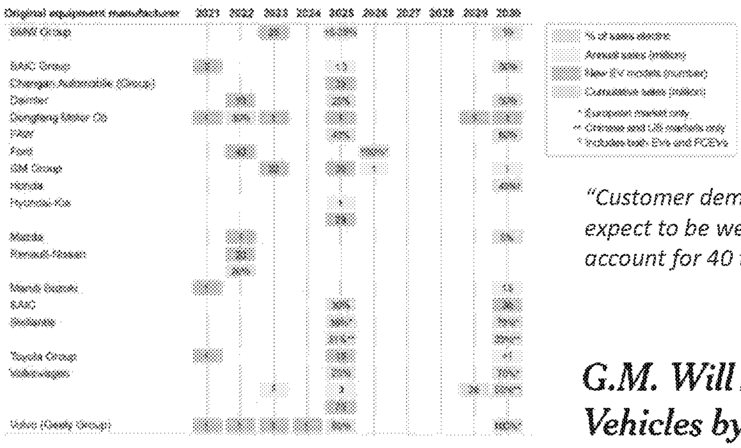


All results draft deliberative. Do not cite or distribute.

*Assumes all or nearly all LD vehicles would need to be EVs to meet economy-wide goals since some other sectors more difficult to decarbonize.

Graph: Internal from Ben Ellies.

Major automakers are on the way



Autos & Transportation

Honda aims for 100% electric vehicles by 2040, says new CEO

April 23, 2021
5:30 AM EDT

REUTERS

"Customer demand has exceeded our expectations. So, we expect to be well positioned to have fully electric vehicles account for 40 to 50% of our U.S. sales by 2030."

--Ford CEO Jim Farley, Aug 5, 2021

G.M. Will Sell Only Zero-Emission Vehicles by 2035

Jan. 28, 2021

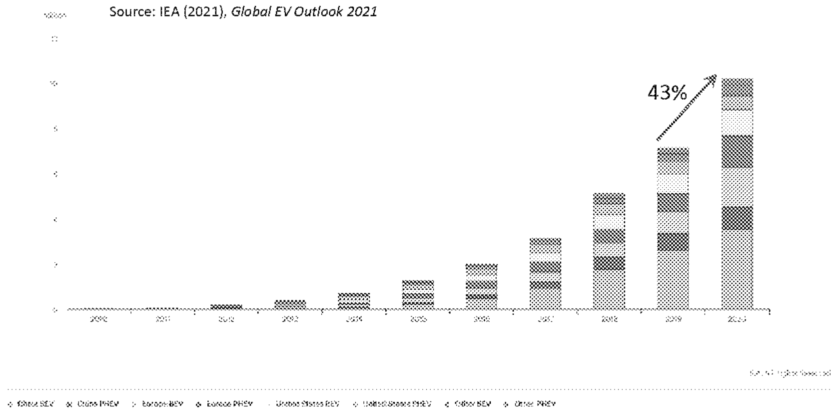
The New York Times

Sources:
International Energy Agency (IEA) (2021), Global EV Outlook 2021, IEA, Paris https://www.iea.org/reports/global-ev-outlook-2021
Includes EVs, PHEVs, and FCVs
https://media.ford.com/content/fordmedia/fna/us/en/news/2021/08/05/ford-statements-electric-vehicle-sales-white-house.html

Global Market: Over 10 Million PEVs on the Road

- Global electric car share rose to 4.6% of new registrations despite COVID
- Up 70% relative to 2019

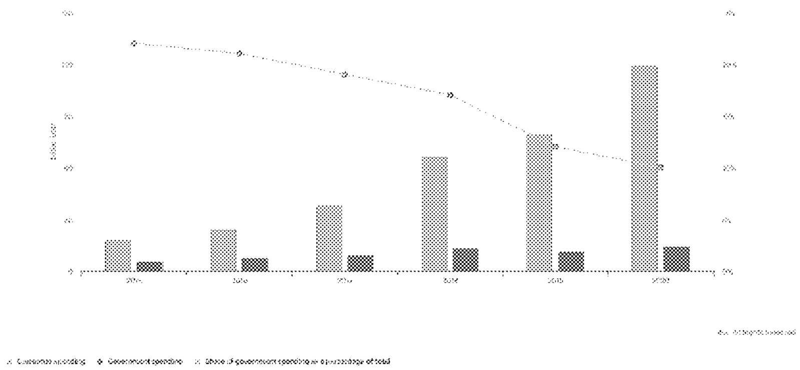
Global Electric Passenger Car Stock, 2010–2020 (millions)



Sources:
International Energy Agency (IEA) (2021), Global EV Outlook 2021, IEA, Paris https://www.iea.org/reports/global-ev-outlook-2021
Includes EVs, PHEVs, and FCVs

EV sales grew despite decrease in relative share of government spending

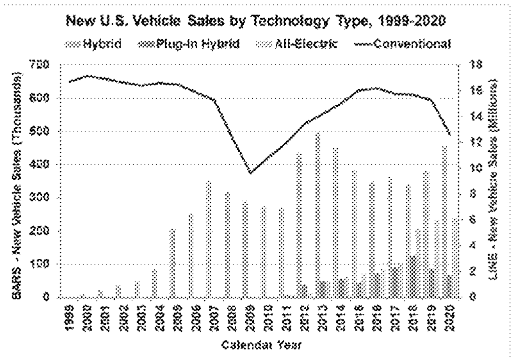
Consumer and government spending on electric cars, 2015–2020



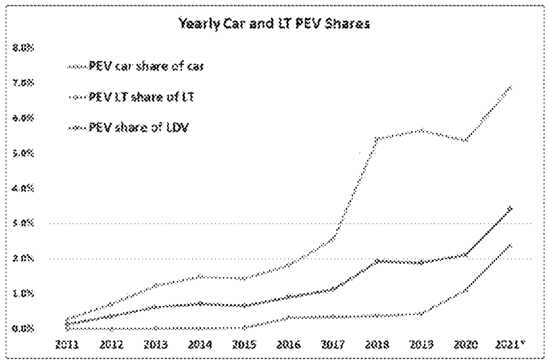
- Consumer spending on EVs up 50% in 2020 (relative to 2019) mostly due to increased sales
- Government spending—direct incentives and tax deductions—seems to be flattening
- Share of total EV spend by government decreased from 20% to 10% in five years

Sources:
International Energy Agency (IEA) (2021), Global EV Outlook 2021, IEA, Paris https://www.iea.org/reports/global-ev-outlook-2021
Includes EVs, PHEVs, and FCVs
"Government incentives are the sum of direct government spending through purchase incentives and foregone revenue due to taxes waived specifically for electric cars. Only national government purchase support policies for electric cars are taken into account. Consumer spending is the total expenditure based on model price, minus government spending."

U.S. EV sales increased in 2020 even as ICE sales dropped



- Conventional vehicle sales dropped 15% in 2020
- BEV sales slightly increased



*Through July

- In July, over 50,000 PEVs sold in July (84% increase from July 2020)
- Share of LDV market now over 3%

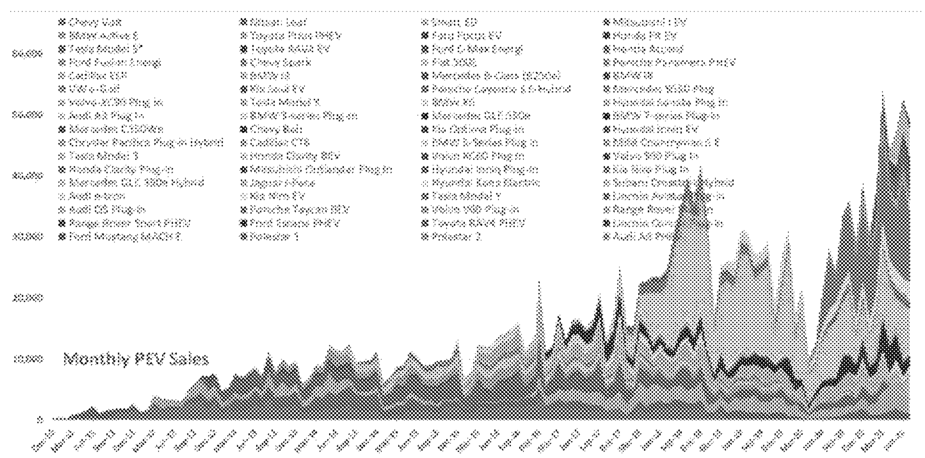
Source: https://www.anl.gov/es/light-duty-electric-drive-vehicles-monthly-sales-updates; 84% increase from sales in July 2020

Over 2M sold in US since 2010
From DOE FOTW 1200: "Conventional new light-duty vehicle sales declined to 12.7 million in 2020, down from 15.3 million in 2019."
https://www.energy.gov/eere/vehicles/articles/fotw-1200-august-23-2021-sales-new-electric-vehicles-us-were-2020-while

U.S. Market: Over 50 EV & PHEV Models Available

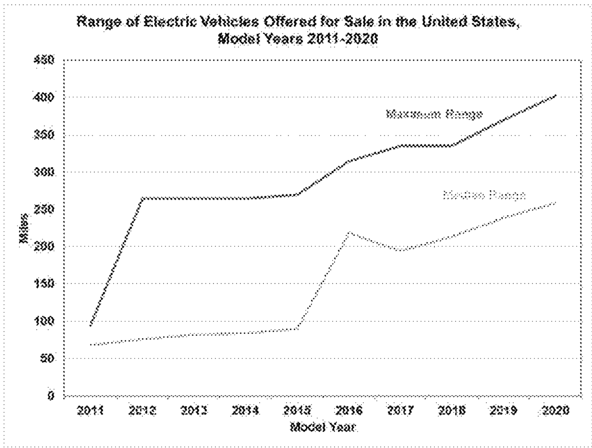
- Includes SUVs, minivan, and soon first all-electric pickup trucks
- BEVs dominating sales:

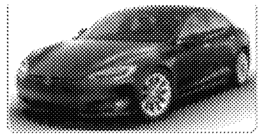
  68% BEVs vs 32% PHEVs (July '21)



Source: https://www.anl.gov/es/light-duty-electric-drive-vehicles-monthly-sales-updates

Median EV range now over 200 miles

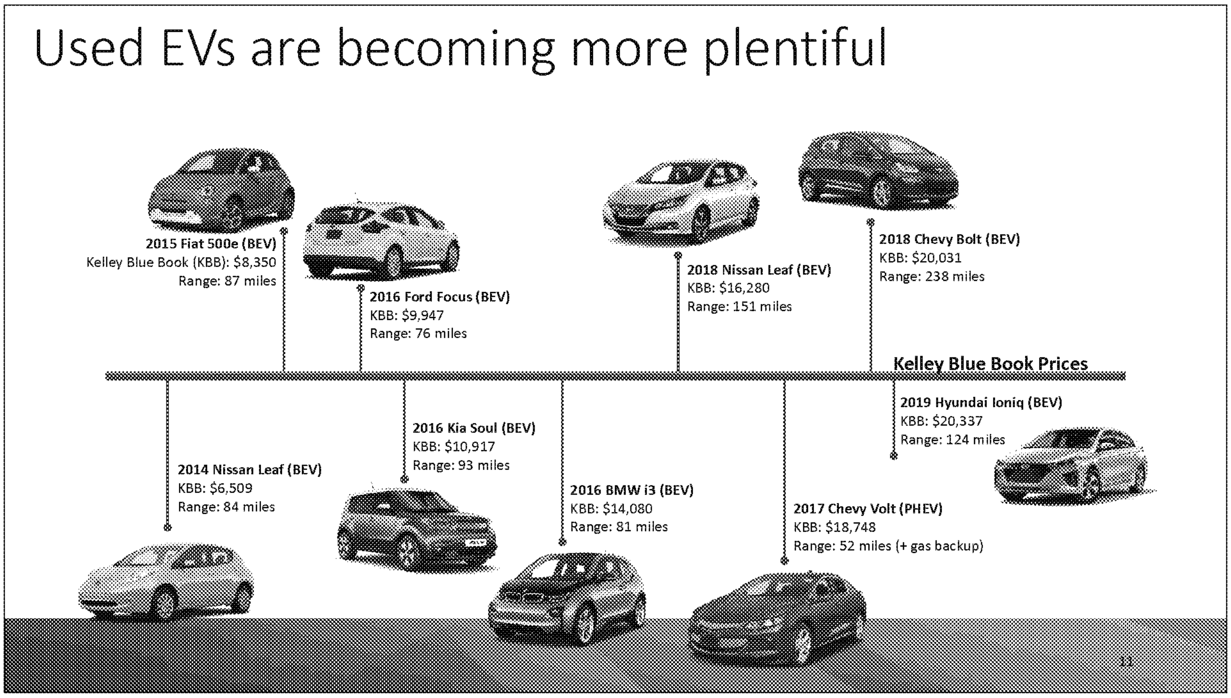




Tesla Model S Long Range Plus

- Maximum range 402 miles: Tesla Model S Long Range Plus
- Over 200 miles: Audi e-tron, Chevy Bolt, Hyundai Kona, Jaguar I-Pace, Kia Niro, Kia Soul, Nissan Leaf, Porsche Taycan, Tesla Model 3, X, Y, & S

Source: https://www.anl.gov/es/light-duty-electric-drive-vehicles-monthly-sales-updates and fueleconomy.gov
Vehicle models listed are from MY2020
From DOE FOTW 1200: “Conventional new light-duty vehicle sales declined to 12.7 million in 2020, down from 15.3 million in 2019.”
https://www.energy.gov/eere/vehicles/articles/fotw-1200-august-23-2021-sales-new-electric-vehicles-us-were-2020-while

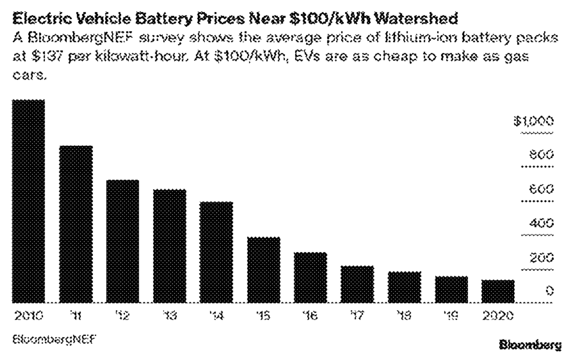


As EVs come off of their 3-year leases, the used EV market is gaining more options from a range of OEMs
Federal regulations require EV battery packs are warrantied by the vehicle manufacturer for at least eight years or 100,000 miles

Source: https://www.kbb.com/car-finder/?seolink=false?intent=used&pricerange=0-45000&vehicletypes=electric&sort=priceasc
KBB used dealer prices as of August 2021

Battery Prices Declining

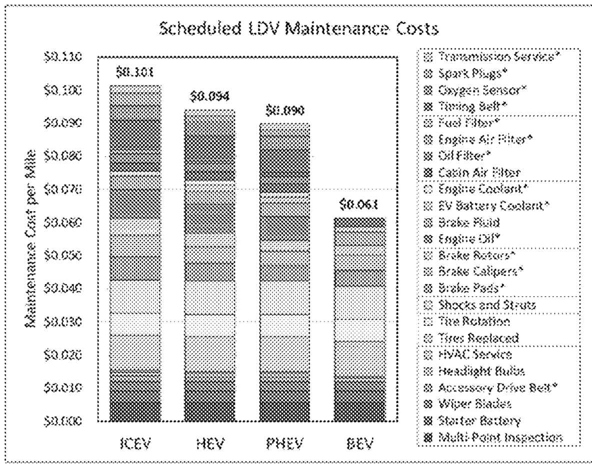
- Lithium-ion battery prices have already dropped over 80% since 2010
- Bloomberg New Energy Finance, among others, predicts upfront cost parity with gas cars in mid-2020s when battery costs reach about $100/kWh
  - Consistent with DOE battery cost targets



Source:
Graph Bloomberg New Energy Finance (BNEF), Electric Vehicle Outlook 2019: https://about.bnef.com/electric-vehicle-outlook/#toc-viewreport
Additional sources used in timeline:
BNEF '18: https://about.bnef.com/electric-vehicle-outlook/
JP Morgan Research: https://www.jpmorgan.com/global/research/electric-vehicles
UBS: https://neo.ubs.com/shared/d1wkuDlEbYPjF/
[Note: UBS defines "true cost of parity" as when OEMs achieve a 5% EBIT margin, not when upfront purchase price is the same. UBS predicts this will be reached in 2028 in the U.S. and 2023 in Europe.]
Bernstein: https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/022619-evs-to-reach-cost-parity-with-internal-combustion-cars-in-3-4-years-bernstein

EVs typically have lower operating costs

- On average, **fuel costs** are about 60% lower when driving electric vs gasoline though wide regional variation
- **Maintenance costs** estimated to be 40% lower per mile for a BEV than an ICE
  - ✓ No engine oil, timing belt, spark plugs, and oxygen sensors etc



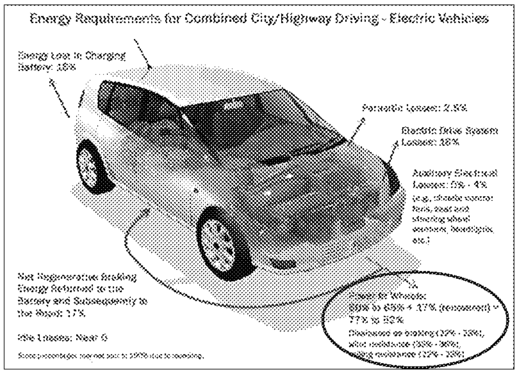
* Service interval varies by powertrain.

Sources: https://www.energy.gov/eere/vehicles/articles/fotw-1186-may-17-2021-national-average-cost-fuel-electric-vehicle-about-60 (March 31, 2021)
DOE FOTW 1190: https://www.energy.gov/eere/vehicles/articles/fotw-1190-june-14-2021-battery-electric-vehicles-have-lower-scheduled

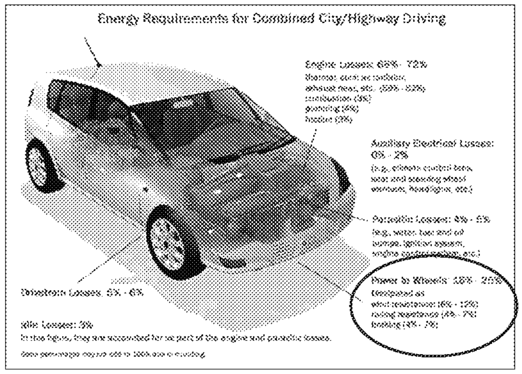
PHEVs and HEVs still save maintenance costs with braking

Electric Vehicles are more efficient

Electric Vehicle



Conventional Car

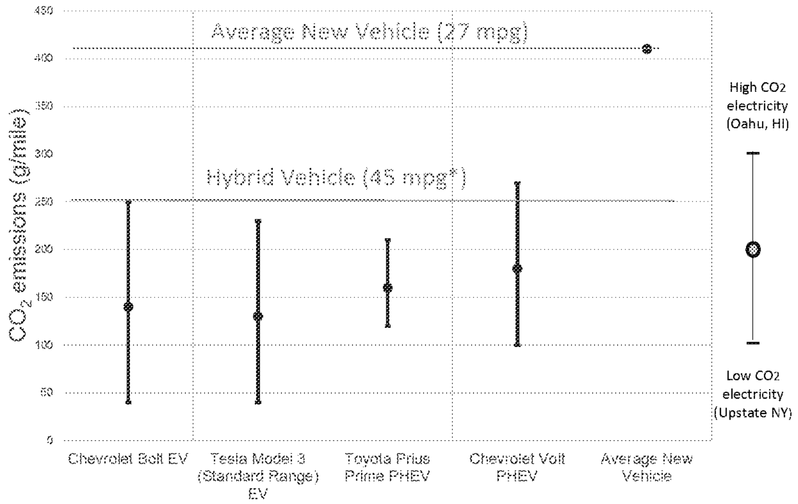


Source: U.S. DOE

About 80% of energy put into an electric vehicle is used to power the wheels vs. about 25% for a conventional car

Sources:
https://www.energy.gov/eere/vehicles/articles/fotw-1045-september-3-2018-77-82-energy-put-electric-car-used-move-car-down
https://www.energy.gov/eere/vehicles/articles/fotw-1044-august-27-2018-12-30-energy-put-conventional-car-used-move-car-down
Additional detail at: https://www.fueleconomy.gov/feg/atv.shtml

EVs have lower carbon footprints than typical ICEs



- Total GHG emissions for EVs are nearly always lower than those of an average gasoline vehicle—even in fossil fuel heavy regions
- We periodically update this information on Fueleconomy.gov in conjunction with DOE

Will update to reflect latest grid estimates

Source: Beyond Tailpipe Calculator on fueleconomy.gov, based on 2016 electricity grid
*Production-weighted MY2017 average from Trends Report

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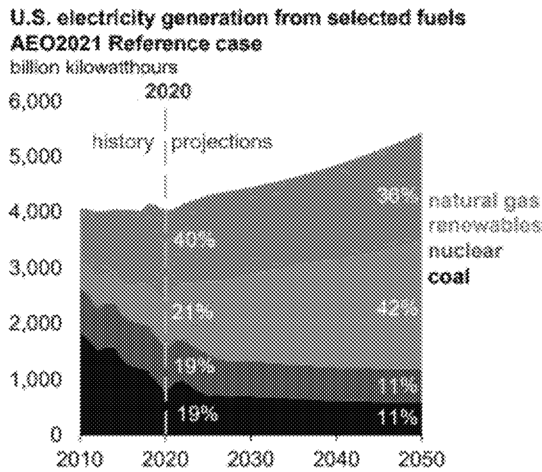
Notes on above analysis:
Estimates shown are from our Beyond Tailpipe Calculator on fueleconomy.gov.
The center dots assume a U.S. average electricity mix. The regions with the lowest and highest CO2 emissions are also displayed.
Highest: Oahu, HI: ~90% fossil fuels (oil & coal)
Lowest: Upstate NY: ~40% renewables, 30% nuclear, 30% natural gas
Modeling: grid emissions (including T&D losses) are from eGRID. Emissions associated with feedstocks (coal, natural gas, etc) are from GREET.
Upstream gasoline emissions are included
Unless noted, vehicle models are MY2019

EV emissions will drop further as grid gets cleaner

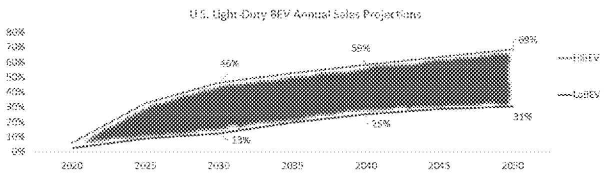
- EV emissions are typically highest when they are driven off the lot
- As the electricity grid gets cleaner, total emissions associated with EVs decreases
  - AEO reference case projects renewables doubling by 2050
  - This does not yet account for Biden's EO setting target for carbon-free electricity sector by 2035

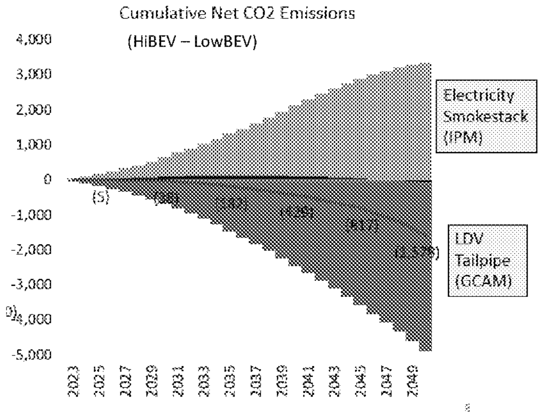


Source: https://www.eia.gov/outlooks/aeo/pdf/04%20AEO2021%20Electricity.pdf

Modeling Future EV Emissions

- TCD has ongoing work with OAP to estimate future EV emissions
  - both greenhouse gases and criteria pollutants
  - accounting for time-of-day charging occurs



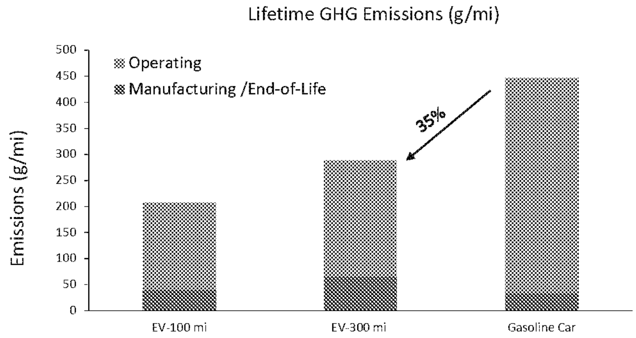


All results draft deliberative. Do not cite or distribute.

What about the Battery?

May update to latest GREET, and to show battery emissions separately

- EVs typically have higher manufacturing emissions due to battery production
- However, CO_2 savings during operation can more than offset these over a vehicle's lifetime—resulting in net CO_2 reductions
- EV also can also be reused (e.g., grid storage) or recycled
  - DOE leading research/partnerships to address challenges with battery recycling
  - Federal Consortium on Advanced Batteries recently sett a long term-objective of a 90% recycling rate



'Manufacturing' includes all emissions associated with the cars' lifecycle, including extracting materials, manufacturing and assembling parts, vehicle assembly, and end-of-life (recyling or disposal). "Operating" includes both tailpipe emissions and the emissions associated with producing gasoline or electricity (U.S. mix). For illustration only,

Data in graph generated from Argonne National Laboratory's GREET Model (GREET2_2019), available at: https://greet.es.anl.gov/
See the U.S. Department of Energy's ReCell Center for more information on battery recycling. Assumed equal VMT per lifetime for all vehicle types.
Federal Consortium on Advanced Batteries recently released a National Blueprint for Lithium Batteries setting a long term-objective of a 90% recycling rate.

Charging Infrastructure

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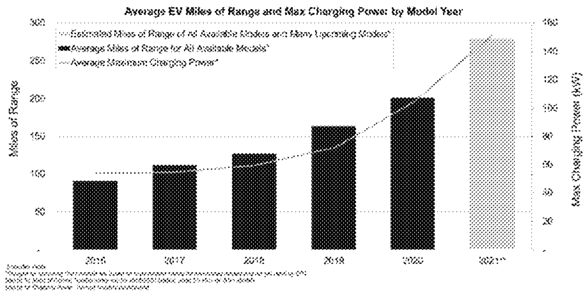
One of the two dual Level 2 charging stations installed at NVFEL in Fall 2017

Types of Charging for LD EVs

- Most charging today is at home (L1 or L2)
- Dwell time can inform most appropriate public charging type (L2 vs. DCFC)
- The maximum charging power EVs can accept is increasing→ faster recharge

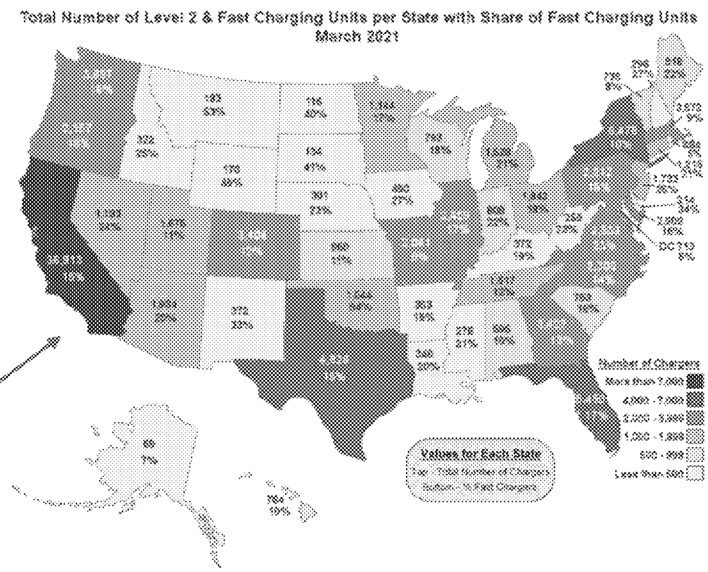


Charging Options	Level 1 (120v)	Level 2 (240v)	Direct-current (DC) Fast Charging
What does the charge port on the vehicle look like?	J1772	J1772	CCS, CHAdeMO
How fast do they charge?	2-5 miles per 1 hour of charging	10-20 miles per 1 hour of charging	At least 60 miles per 20 minutes of charging Charging time may be shorter depending on station power*

Source: Green Vehicle Guide, https://www.epa.gov/greenvehicles/plug-electric-vehicle-charging and Elctrify America Cycle 3 National Plan: https://www.electrifyamerica.com/assets/pdf/cycle3_investment_plan_epa.a19109d1.pdf

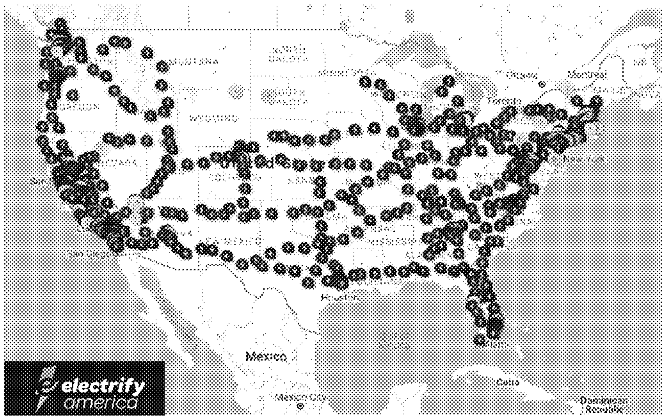
Charging stations across all states

- Over 40,000 public charging stations in U.S. with >100,000 chargers
  - Most L2, but DC Fast is increasing
- Half of all states have 1000 or more non-residential chargers (public & private)



Sources: DOE FOTW 1184: https://www.energy.gov/eere/vehicles/articles/fotw-1184-may-3-2021-half-all-states-now-have-least-1000-non-residential
Includes L2 & DCFC public and private chargers; includes Tesla

...and many more are coming



- VW Clean Air Act Civil Settlement includes a requirement for VW spend $2 billion over 10 years to advance zero emission vehicles
- Electrify America—VW subsidiary— now has > 650 EV charging stations across United States with hundreds more planned
  - Completed two cross-country routes
  - In 2020, opened stations at pace of nearly 3 per week
- States, utilities, workplaces, EVSE providers (e.g., EVgo, Chargepoint), Tesla, and others also installing stations

Source: Electrify America 9.12.21

How many chargers do we need?

→TCD working with NREL through Interagency Agreement to refine underlying model and enhance tool for state/local governments

A 2017 NREL study found only ~400 fast charging stations needed on highway corridors to provide basic network of coverage (70 mi spacing)

But **many more** will be needed to meet demand as EV penetration grows, particularly in cities

Plugs needed per 1,000 PEVs	DC Fast Chargers	Level 2 (non-residential)
Cities	1.5	36
Towns	2.2	54
Rural Areas	3.1	79

If 15M PEVs in 2030 (20% of LD sales), then need approx.

- **600,000 L2 non-residential chargers AND**
- **25,000 fast charging plugs in communities**

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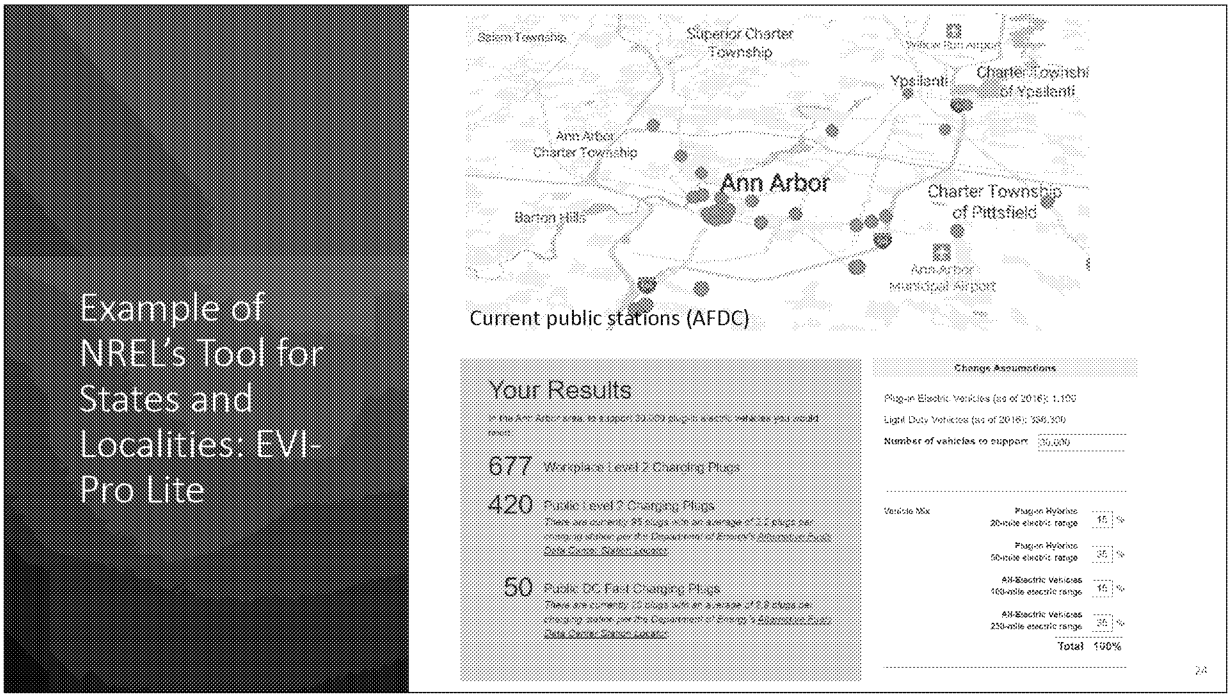
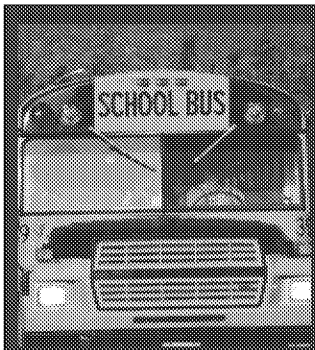
Source: NREL National Plug-in Electric Vehicle Infrastructure Analysis, https://www.nrel.gov/docs/fy17osti/69031.pdf?utm_source=NREL+News&utm_campaign=888314f4c5-EMAIL_NR_PEV_CHARGING_2017_10_04&utm_medium=email&utm_term=0_807f77e7f4-888314f4c5-282475801



https://afdc.energy.gov/fuels/electricity_locations.html#/find/nearest?fuel=ELEC&country=US
And EVI-Pro Lite



Infrastructure Bill Highlights

Electric school buses

- $2.5B for zero emission school buses
- $2.5B for low emission buses
- Lead agency: EPA

Charging and fueling infrastructure

- $5B for EV Corridors under National EV Formula Program
- $2.5B for grant program supporting alternative fuel infrastructure (including charging)
- Lead agency: DOT

Photo from epa.gov/dera

Appendix

Public Charging Costs

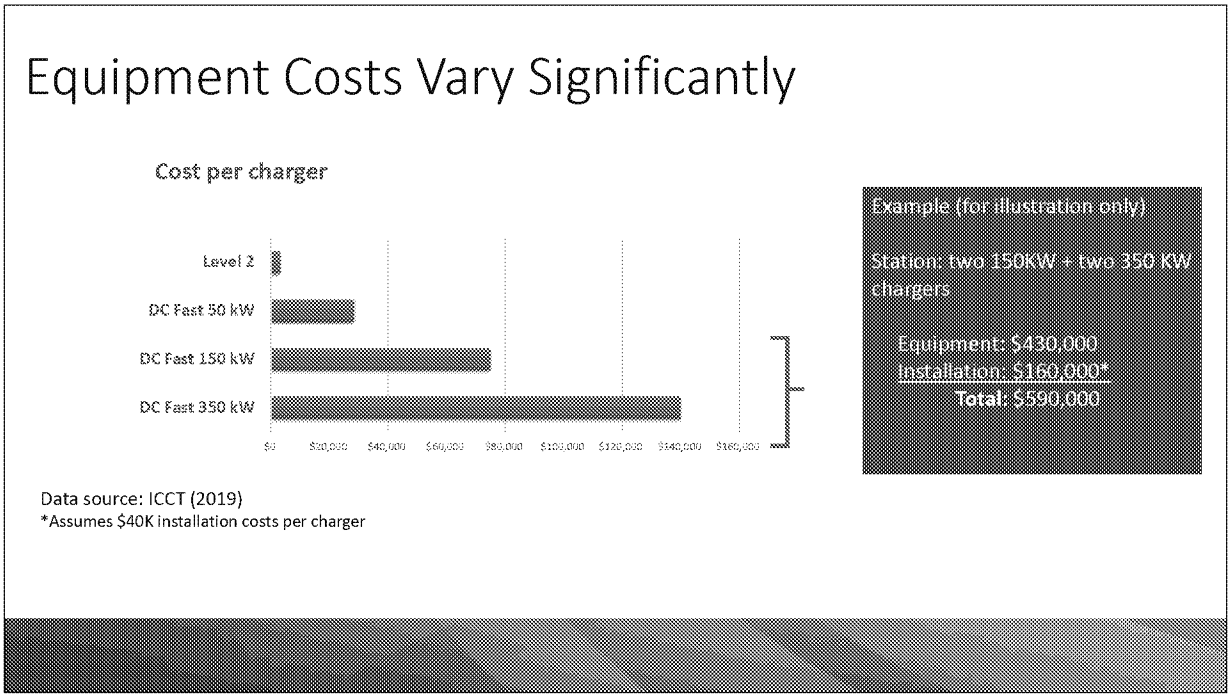
Level	Equipment Cost (per charger)	Installation Cost
1	$300-1,500	$300-5,000
2	$300-6,500	$1,000-10,000
DC Fast	$20,000-150,000	$20,000-96,000*

Sources: ICCT (2019), Avista (2019), RMI (2019), Borlugh et. al (2020), NYSERDA (2018)

*96K installation estimate for site with CCS & CHAdeMO connectors plus L2

- Equipment costs vary by:
  - power level
  - number of charging points and
  - specifications, e.g., wall-mount vs. pedestal mount, networking capability
- Installation costs vary by:
  - geographic location (e.g., site acquisition, permitting challenges)
  - trenching/boring needs
  - electrical upgrades
- DCFC stations may encounter additional costs associated with any necessary upgrades to utility transmission and distribution infrastructure

Sources:
ICCT (2019): https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf
Avista (2019): https://myavista.com/-/media/myavista/content-documents/energy-savings/electricvehiclesupplyequipmentpilotfinalreport.pdf
RMI (2019): https://rmi.org/insight/reducing-ev-charging-infrastructure-costs/
Borlaug et al. (2020): Levelized Cost of Charging Electric Vehicles in the United States
NYSERDA (2018): Strategies and Techniques for Reducing the Installation and Operating Costs of EVSE, available at: https://www.nyserda.ny.gov/all-programs/programs/chargeny/charge-electric/best-practices

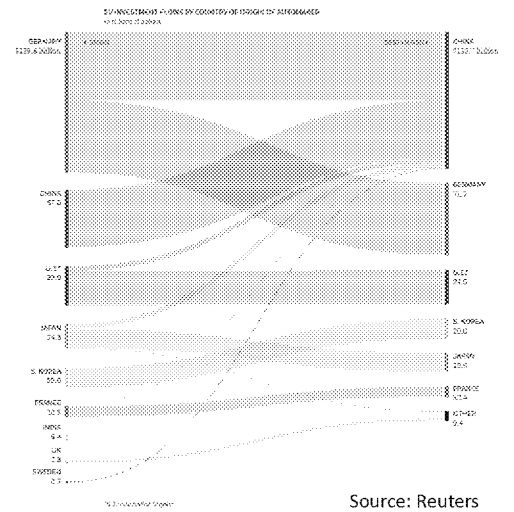


Source: ICCT (2019): https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf
Costs shown in bar chart are for networked chargers; one charger per pedestal.
Installation cost estimate: assumes $40K installation per charger, which is the approximate per charger estimate in ICCT (2019) for 350 kW chargers.

Checking to see if I can replace with updated total/figure; may move to Appendix

Automakers are Investing

- **$300 Billion in EVs and Batteries**
  - Investment by 29 global automakers over 5–10 yrs announced as of early 2019
  - Likely underestimates total EV investment
    - Doesn't include automotive suppliers
    - A separate analysis found $20 billion in venture capital for electrification startups (Reuters)
  - For context, overall auto R&D spending has been about $100B/yr in recent years (PwC, Auto Alliance)

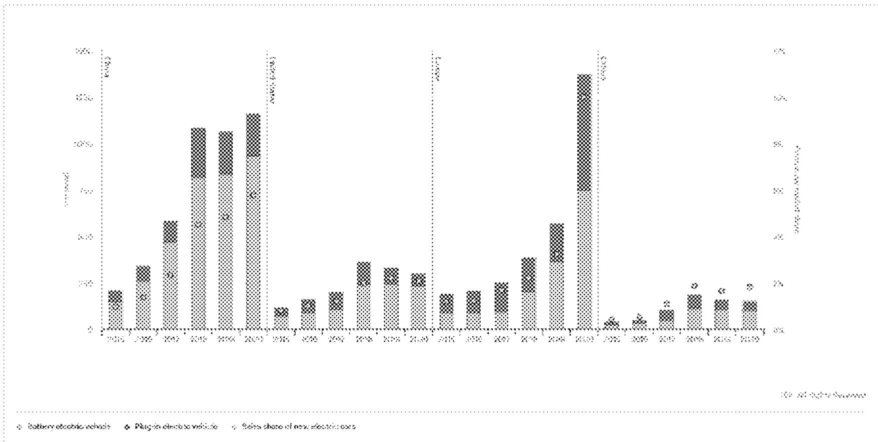


Source: Reuters

Sources:
https://graphics.reuters.com/AUTOS-INVESTMENT-ELECTRIC/010081ZB3HD/index.html
https://www.reuters.com/article/us-autoshow-detroit-electric-exclusive/exclusive-vw-china-spearhead-300-billion-global-drive-to-electrify-cars-idUSKCN1P40G6
https://www.reuters.com/article/us-autoshow-detroit-startups-electric-an/corporate-investors-pile-into-electric-vehicle-startups-idUSKCN1P52DC

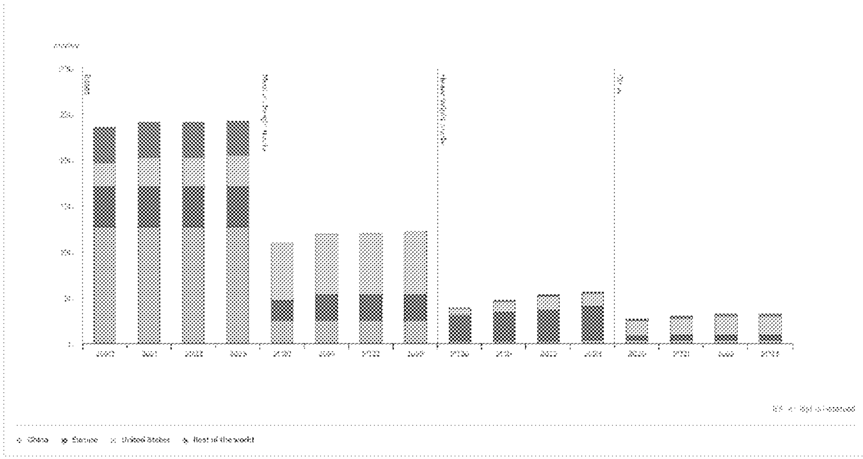
Overall R&D budget:
https://autoalliance.org/innovation/
[Global automakers spent ~$109B in 2017.]
https://www.strategyand.pwc.com/media/file/2018-Global-Innovation-1000-Fact-Pack.pdf
[Graph on p.28 shows auto R&D between $99B and $109B from 2

Global EV Market Share by Country



Sources:
International Energy Agency (IEA) (2021), Global EV Outlook 2021, IEA, Paris https://www.iea.org/reports/global-ev-outlook-2021
Includes EVs, PHEVs, and FCVs

HDV model availability also increasing globally



Sources:
International Energy Agency (IEA) (2021), Global EV Outlook 2021, IEA, Paris https://www.iea.org/reports/global-ev-outlook-2021
Includes EVs, PHEVs, and FCVs

Provide sector demand increasing

Private sector demand for zero-emission commercial vehicles amplifies market signals for OEMs to develop EVs

Company	Operating area	Announced	Target / actions
Amazon	Global	2020	Orders 100 000 BEV light-commercial vehicles from start-up company Rivian. Amazon aims to be net-zero emissions by 2040
Anheuser-Busch	United States	2019	Orders up to 800 hydrogen fuel cell Nikola heavy-duty trucks.
DHL Group	Global	2019	Delivery of mail and parcels by EVs in the medium term and net-zero emissions logistics by 2050.
FedEx	Global	2018	Transition to an all zero-emission vehicle fleet and carbon neutral operations by 2040.
H_2 Mobility Association	Switzerland	2019	19 of Switzerland's largest retailers invest in Hyundai hydrogen trucking services that will deploy up to 1 600 heavy-duty zero-emission trucks.
Ingka Group (IKEA)	Global	2018	Zero-emission deliveries in leading cities by 2020 and in all cities by 2025.
Japan Post	Japan	2019	Electrify 1 200 mail and parcel delivery vans by 2021 and net-zero emissions logistics by 2050.
JD	China	2017	Replace entire vehicle fleet (> 10 000) with New Energy vehicles by 2022
SF Express	China	2018	Launch nearly 10 000 BEV logistics vehicles.
Suning	China	2018	Independent retailer Qingcheng Plus will deploy 5 000 new energy logistics vehicles
UPS	North America	2019	Order 10 000 BEV light-commercial vehicles with potential for a second order.
Various companies	Multinational	2018	Walmart, Pepsi, Anheuser-Busch, FedEx, Sysco and other large multinational corporations pre-order 2 000 Tesla Semi models within six months of truck's debut.
Walmart	United States	2020	Electrify the whole vehicle fleet by 2040.

[illegible]

Sources:
International Energy Agency (IEA) (2021), Global EV Outlook 2021, IEA, Paris https://www.iea.org/reports/global-ev-outlook-2021
Includes EVs, PHEVs, and FCVs

Message

From: Simpson, Jonathan [Simpson.Jonathan@epa.gov]
Sent: 10/22/2021 3:06:51 PM
To: Abrams, Nancy [Abrams.Nancy@epa.gov]; Buzzelle, Stanley [Buzzelle.Stanley@epa.gov]; Dalbey, Matthew [Dalbey.Matthew@epa.gov]; Daniels, Jessica [daniels.jessica@epa.gov]; Gunning, Paul [Gunning.Paul@epa.gov]; Hoppe, Allison [hoppe.allison@epa.gov]; Kopits, Elizabeth [Kopits.Elizabeth@epa.gov]; Macedonia, Jennifer [Macedonia.Jennifer@epa.gov]; McGartland, Al [McGartland.Al@epa.gov]; Marshall, Tom [marshall.tom@epa.gov]; Munis, Ken [Munis.Ken@epa.gov]; Patulski, Meg [patulski.meg@epa.gov]; Ragnauth, Shaun [Ragnauth.Shaun@epa.gov]; Scheraga, Joel [Scheraga.Joel@epa.gov]; Schmeltz, Rachel [Schmeltz.Rachel@epa.gov]; Serassio, Helen [Serassio.Helen@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Susman, Megan [Susman.Megan@epa.gov]; Tejada, Matthew [Tejada.Matthew@epa.gov]; Tomiak, Robert [tomiak.robert@epa.gov]; EPA NEPA Regional Managers [EPA_NEPA_Regional_Managers@epa.gov]; Dean, Kenneth [Dean.William-Kenneth@epa.gov]; Sedlacek, Michael [Sedlacek.Michael@epa.gov]; Appleton, Zac [Appleton.Zac@epa.gov]; Sturges, Susan [Sturges.Susan@epa.gov]; Pepple, Karl [Pepple.Karl@epa.gov]
CC: Barger, Cindy [Barger.Cindy@epa.gov]; Rountree, Marthea [Rountree.Marthea@epa.gov]; Schaedle, Candi [Schaedle.Candi@epa.gov]
Subject: Comment Letter - Postal Service Draft EIS for Next Generation Delivery Vehicle (NGDV) Acquisitions
Attachments: USPS EPA Cover Letter October 2021.pdf; USPS NGDV Draft EIS detailed comments only_21Oct2021 Final.pdf

All –

Attached are the cover letter and EPA's detailed comments on the Postal Service's Draft EIS for Next Generation Delivery Vehicle (NGDV) Acquisitions.

On behalf of Rob Tomiak, Cindy Barger, and the entire NCD staff, thank you for your thoughtful contributions and diligent efforts in formulating these comments.

Feel free to contact me or Cindy if you have any questions or concerns.

Jonathan

Jonathan Simpson
NEPA Compliance Division
Office of Federal Activities
U.S. Environmental Protection Agency
Washington, DC
Tel: 202-564-8168

Message

From: Moran, Robin [moran.robin@epa.gov]
Sent: 10/25/2021 7:33:23 PM
To: OAR Briefings [OAR_Briefings@epa.gov]
CC: OTAQ Materials [OTAQMaterials@epa.gov]; Charmley, William [charmley.william@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Dickinson, David [Dickinson.David@epa.gov]; Wysor, Tad [wysor.tad@epa.gov]; Miller, Elizabeth [Miller.Elizabeth@epa.gov]; Sherwood, Todd [sherwood.todd@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Lieske, Christopher [lieske.christopher@epa.gov]; Srinivasan, Gautam [Srinivasan.Gautam@epa.gov]; Orlin, David [Orlin.David@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]; Buchsbaum, Seth [buchsbaum.seth@epa.gov]; Okoye, Winifred [Okoye.Winifred@epa.gov]
Subject: Materials for Tuesday's 12noon Light-Duty Vehicle Update
Attachments: LDV GHG FRM_Hybrid Alternative and Flexibilities_for OAR_draft3.pptx

Dear OAR,

For our noon LDV Update tomorrow, attached is a briefing on our updated analysis including the Hybrid Alternative, and our staff recommendations on the four Flexibilities. This is a pre-brief for the second round of Options Selection with the Administrator.

Thanks,
Robin

Robin Moran (she/her)
Senior Policy Advisor
U.S. EPA, Office of Transportation and Air Quality
2000 Traverwood Dr.
Ann Arbor, MI 48105
(734) 214-4781

Message

From: Moran, Robin [moran.robin@epa.gov]
Sent: 10/26/2021 7:19:51 PM
To: Dunham, Sarah [Dunham.Sarah@epa.gov]
CC: OTAQ Materials [OTAQMaterials@epa.gov]; Charmley, William [charmley.william@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Dickinson, David [Dickinson.David@epa.gov]; Wysor, Tad [wysor.tad@epa.gov]; Miller, Elizabeth [Miller.Elizabeth@epa.gov]; Sherwood, Todd [sherwood.todd@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Lieske, Christopher [lieske.christopher@epa.gov]; Srinivasan, Gautam [Srinivasan.Gautam@epa.gov]; Orlin, David [Orlin.David@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]; Buchsbaum, Seth [buchsbaum.seth@epa.gov]; Okoye, Winifred [Okoye.Winifred@epa.gov]
Subject: RE: Materials for Tuesday's 12noon Light-Duty Vehicle Update
Attachments: LDV GHG Final Rule_pre-brief for Options Selection part 2.pptx

Thanks Sarah, that was easy. Attached is the version for the pre-brief on Thursday.

As you said, we'll revert to today's version for the formal OS briefing on Monday.

From: Dunham, Sarah <Dunham.Sarah@epa.gov>
Sent: Tuesday, October 26, 2021 1:52 PM
To: Moran, Robin <moran.robin@epa.gov>
Cc: OTAQ Materials <OTAQMaterials@epa.gov>; Charmley, William <charmley.william@epa.gov>; Olechiw, Michael <olechiw.michael@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>; Dickinson, David <Dickinson.David@epa.gov>; Wysor, Tad <wysor.tad@epa.gov>; Miller, Elizabeth <Miller.Elizabeth@epa.gov>; Sherwood, Todd <sherwood.todd@epa.gov>; Bolon, Kevin <Bolon.Kevin@epa.gov>; Lieske, Christopher <lieske.christopher@epa.gov>; Srinivasan, Gautam <Srinivasan.Gautam@epa.gov>; Orlin, David <Orlin.David@epa.gov>; Kataoka, Mark <Kataoka.Mark@epa.gov>; Buchsbaum, Seth <buchsbaum.seth@epa.gov>; Okoye, Winifred <Okoye.Winifred@epa.gov>
Subject: RE: Materials for Tuesday's 12noon Light-Duty Vehicle Update

Thanks for going through this today with Joe. With Joe and Ale after the meeting, they advised for Thursday's briefing that you move the slide that begins the appendix to after slide6. So the slides after slide 6 would essentially be moved into the appendix.

Then for the Monday options selection meeting it can be as is (the way you sent the slides up for today)

From: Moran, Robin <moran.robin@epa.gov>
Sent: Monday, October 25, 2021 3:33 PM
To: OAR Briefings <OAR_Briefings@epa.gov>
Cc: OTAQ Materials <OTAQMaterials@epa.gov>; Charmley, William <charmley.william@epa.gov>; Olechiw, Michael <olechiw.michael@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>; Dickinson, David <Dickinson.David@epa.gov>; Wysor, Tad <wysor.tad@epa.gov>; Miller, Elizabeth <Miller.Elizabeth@epa.gov>; Sherwood, Todd <sherwood.todd@epa.gov>; Bolon, Kevin <Bolon.Kevin@epa.gov>; Lieske, Christopher <lieske.christopher@epa.gov>; Srinivasan, Gautam <Srinivasan.Gautam@epa.gov>; Orlin, David <Orlin.David@epa.gov>; Kataoka, Mark <Kataoka.Mark@epa.gov>; Buchsbaum, Seth <buchsbaum.seth@epa.gov>; Okoye, Winifred <Okoye.Winifred@epa.gov>
Subject: Materials for Tuesday's 12noon Light-Duty Vehicle Update

Dear OAR,

For our noon LDV Update tomorrow, attached is a briefing on our updated analysis including the Hybrid Alternative, and our staff recommendations on the four

Flexibilities. This is a pre-brief for the second round of Options Selection with the Administrator.

Thanks,
Robin

Robin Moran (she/her)
Senior Policy Advisor
U.S. EPA, Office of Transportation and Air Quality
2000 Traverwood Dr.
Ann Arbor, MI 48105
(734) 214-4781

Message

From: Lance, Kathleen [Lance.Kathleen@epa.gov]
Sent: 10/29/2021 8:49:29 PM
To: Utech, Dan [Utech.Dan@epa.gov]; Lucey, John [Lucey.John.D@epa.gov]; Cassady, Alison [Cassady.Alison@epa.gov]; Goffman, Joseph [Goffman.Joseph@epa.gov]; Nunez, Alejandra [Nunez.Alejandra@epa.gov]; Campbell, Ann [Campbell.Ann@epa.gov]; Kim, Eunjung [Kim.Eun@epa.gov]; Dunham, Sarah [Dunham.Sarah@epa.gov]; Hengst, Benjamin [Hengst.Benjamin@epa.gov]; Mroz, Jessica [mroz.jessica@epa.gov]; Burch, Julia [Burch.Julia@epa.gov]; Charmley, William [charmley.william@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Moran, Robin [moran.robin@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Wysor, Tad [wysor.tad@epa.gov]; Miller, Elizabeth [Miller.Elizabeth@epa.gov]; Niebling, William [Niebling.William@epa.gov]; Werner, Christopher [Werner.Christopher@epa.gov]; Hoffer, Melissa [Hoffer.Melissa@epa.gov]; Prabhu, Aditi [Prabhu.Aditi@epa.gov]; Srinivasan, Gautam [Srinivasan.Gautam@epa.gov]; Orlin, David [Orlin.David@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]; Buchsbaum, Seth [buchsbaum.seth@epa.gov]; Arroyo, Victoria [Arroyo.Victoria@epa.gov]; Miles-McLean, Stuart [Miles-Mclean.Stuart@epa.gov]; Lamson, Amy [Lamson.Amy@epa.gov]; Nagelhout, Peter [Nagelhout.Peter@epa.gov]; Cooperstein, Sharon [Cooperstein.Sharon@epa.gov]; Simon, Nathalie [Simon.Nathalie@epa.gov]; OP ADP Calendar [OP_ADP_Calendar@epa.gov]; Starfield, Lawrence [Starfield.Lawrence@epa.gov]; Bartlett, Keith [Bartlett.Keith@epa.gov]; Alexander, David [Alexander.David@epa.gov]; Cascio, Wayne [Cascio.Wayne@epa.gov]; Benner, Tim [Benner.Tim@epa.gov]; Watkins, Stephen [watkins.stephen@epa.gov]; Ross, Mary [Ross.Mary@epa.gov]; Frey, Christopher [Frey.Christopher@epa.gov]; Szaro, Deb [Szaro.Deb@epa.gov]; Rogan, John [Rogan.John@epa.gov]; Wong, Shutsu [Wong.Shutsu@epa.gov]; Jordan, Deborah [Jordan.Deborah@epa.gov]; Mikulin, John [MIKULIN.JOHN@EPA.GOV]; Adams, Elizabeth [Adams.Elizabeth@epa.gov]; Lakin, Matt [Lakin.Matthew@epa.gov]; Machol, Ben [Machol.Ben@epa.gov]; McDaniel, Penelope [MCDANIEL.PENELOPE@EPA.GOV]; Aspy, Dale [Aspy.Dale@epa.gov]; Martin, Tina [martin.tina@epa.gov]; Blevins, John [Blevins.John@epa.gov]; Freeman, Caroline [Freeman.Caroline@epa.gov]; Monell, Carol [Monell.Carol@epa.gov]; Ortega, Kellie [Ortega.Kellie@epa.gov]; Fine, Philip [Fine.Philip@epa.gov]
CC: McCabe, Janet [McCabe.Janet@epa.gov]; Lamy, Kendra [Lamy.Kendra@epa.gov]; Morgan, Ashley [Morgan.Ashley.M@epa.gov]
Subject: RE: Video-call: Second Options Selection Meeting for Revised Light-Duty Vehicle GHG Emissions Standards FRM
Attachments: 2021 11 01 OAR Briefing Memo Options Selection 2 for LDV GHG FRM - Briefing Memo.docx; 2021 11 01 OAR Slide Deck Options Selection 2 LDV FRM - Slides.pptx

Materials attached for Monday's 12:15PM call.

-----Original Appointment-----
From: scheduling
Sent: Wednesday, October 20, 2021 6:42 PM
To: scheduling; Utech, Dan; Lucey, John; Cassady, Alison; Goffman, Joseph; Nunez, Alejandra; Campbell, Ann; Kim, Eunjung; Dunham, Sarah; Hengst, Benjamin; Mroz, Jessica; Burch, Julia; Charmley, William; Simon, Karl; Moran, Robin; Olechiw, Michael; Wysor, Tad; Miller, Elizabeth; Niebling, William; Werner, Christopher; Melissa Hoffer; Prabhu, Aditi; Srinivasan, Gautam; Orlin, David; Kataoka, Mark; Buchsbaum, Seth; Victoria Arroyo; Miles-McLean, Stuart; Lamson, Amy; Nagelhout, Peter; Cooperstein, Sharon; Simon, Nathalie; OP ADP Calendar; Lawrence Starfield; Bartlett, Keith; Alexander, David; Cascio, Wayne; Benner, Tim; Watkins, Stephen; Ross, Mary; Frey, Christopher; Deborah Szaro; Rogan, John; Wong, Shutsu; Deborah Jordan; Mikulin, John; Adams, Elizabeth; Lakin, Matt; Machol, Ben; McDaniel, Penelope; Aspy, Dale; Martin, Tina; John Blevins; Freeman, Caroline; Carol Monell (Monell.Carol@epa.gov); Ortega, Kellie; Fine, Philip
Cc: McCabe, Janet; Lamy, Kendra
Subject: Video-call: Second Options Selection Meeting for Revised Light-Duty Vehicle GHG Emissions Standards FRM
When: Monday, November 1, 2021 12:15 PM-1:15 PM (UTC-05:00) Eastern Time (US & Canada).
Where: Microsoft Teams Meeting

Please do not forward this invitation. Please notify scheduling@epa.gov if participant changes need to be made.

Administrator Regan

Dan Utech
John Lucey
Alison Cassady
DA Janet McCabe – Optional

Virtual:
Joseph Goffman, OAR
Alejandra Nunez, OAR
Ann Campbell, OAR
Eunjung Kim, OAR
Sarah Dunham, OAR
Benjamin Hengst, OAR
Jessie Mroz, OAR
Julia Burch, OAR
William Charmley, OAR
Karl Simon, OAR
Robin Moran, OAR
Michael Olechiw, OAR
Tad Wysor, OAR
Elizabeth Miller, OAR
Christopher Werner, OAR
Melissa Hoffer, OGC
Aditi Prabhu, OGC
Gautam Srinivasan, OGC
David Orlin, OGC
Mark Kataoka, OGC
Seth Buchsbaum, OGC
Victoria Arroyo, OP
Stuart Miles-McLean, OP
Amy Lamson, OP
Peter Nagelhout, OP
Sharon Cooperstein, OP
Nathalie Simon, OP
OP ADP Calendar (OP_ADP_Calendar@epa.gov)
Lawrence Starfield, OECA
Keith Bartlett, OECA
David Alexander, OECA
Wayne Cascio, ORD
Tim Benner, ORD
Stephen Watkins, ORD
Mary Ross, ORD
Christopher Frey, ORD
Deb Szaro, R01
John Rogan, R01
Shutsu Wong, R01
Deborah Jordan, R09
John Mikulin, R09
Elizabeth Adams, R09
Matt Lakin, R09
Ben Machol, R09
Penelope McDaniel, R09
Dale Aspy, R04
Tina Martin, R04

John Blevins, R04
Caroline Freeman, R04
Carol Monell, R04
Kellie Ortega, OECA
William Niebling, OCIR
Kendra Lamy-optional
Phil Fine

Microsoft Teams meeting

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sip:teams@video.epa.gov
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By participating in EPA hosted virtual meetings and events, you are consenting to abide by the agency's terms of use. In addition, you acknowledge that content you post may be collected and used in support of FOIA and eDiscovery activities.

Learn More | Meeting options

Message

From: Tanman, Arman [Tanman.Arman@epa.gov]
Sent: 8/8/2018 6:37:52 PM
To: jimalvis@kia-dc.com; william_chernicoff@tma.toyota.com; dgreenhaus@nada.org; hillebrand@anl.gov; tom.hollowell@wthconsulting.com; ken.howden@ee.doe.gov; ken.katz@dot.gov; kellyp@api.org; james_kliesch@ahm.honda.com; jrege@globalautomakers.org; aschaeffer@dieselforum.org; sschmidt@autoalliance.org; michael.d.scott@daimler.com; sluders@ornl.gov; smithrl4@ornl.gov; stephane.thiriez@na.mitsubishi-motors.com; whwalshjr@aol.com; Colette.Wright@sae.org; Robert_Wimmer@toyota.com; william.chernicoff@toyota.com; STatman@autoalliance.org; robert.wimmer@toyota.com; lholmes@mema.org; jeichberger@fuelsinstitute.org; William.Craven@daimler.com; patricia.strabbing@fcagroup.com; daniel.selke@mbusa.com; nadir.yilmaz@howard.edu; mjena@sae.org; Vickie and Tom Hollowell [tvhollowell@gmail.com]; Marc.LeDuc@sae.org; Simon, Karl [Simon.Karl@epa.gov]; stephen.summers@dot.gov; 'Peter.Martin@dot.gov'; Machiele, Paul [machiele.paul@epa.gov]; Ezra Finkin [efinkin@dieselforum.org]; Martin, Peter (NHTSA [Peter.Martin@dot.gov]
CC: Melissa Jena [Melissa.Jena@sae.org]
Subject: RE: 2019 SAE G/I Environment & Energy Sessions Planning Meeting follow-up
Attachments: 2019 SAE GI -EE Session Ideas V3.docx

Hi Environmental and Energy Sessions planning group,
I have updated our list of sessions based on our discussion yesterday at our committee meeting, but there is still a lot to discuss. Developing the descriptions and identifying the organizers for all the sessions. Some people mentioned that while all these ideas are still fresh on our minds that we should have another conference call next week. Please let me know by this Friday noon when you prefer to have a call next week, next Wednesday or Thursday 2 or 3pm. On Friday afternoon I can send out a meeting notice for our next conference call.
If you cannot make it please sends us your thoughts on the sessions, additional description and or possible organizers for the sessions and I can add it to the session ideas document before our call.
Thanks for all your help,
Arman

Arman Tanman
Mechanical/Environmental Engineer
U.S. Environmental Protection Agency
Office of Transportation and Air Quality
Transportation and Climate Division, Technology Assessment Center (6406A)
1200 Pennsylvania Ave., N.W.
Washington, D.C. 20460
(202) 343-9326 phone

DRAFT
Environmental and Energy Session ideas for 2019 SAE G/I Meeting

1) Light Duty GHG/CAFE

This session examines the latest analytic and policy implications to light duty CAFE and GHG standards. Government, industry and policy leaders will share recent findings, and provide perspective on both the ongoing and the post-2025 regulatory environment.

Organizers: Jim Kliesch - Honda, email: [HYPERLINK "mailto:james_kliesch@ahm.honda.com"]
Kevin Bolon – EPA, email: [HYPERLINK "mailto:Bolon.kevin@Epa.gov"]
Ken Katz – NHTSA, email: ken.katz@dot.gov

2) Electric Drive Part 1 – Models, Markets and Technology

This session will cover the global trends in EV:

- What are the policies driving these trends? (To include recent development in U.S. policy on fuel economy standards/rollback).
- Trends by region (Americas, Europe, Asia (esp. China's EV efforts), other)
- Impact on EV Market, moving forward
- Market Trends
- Impact of Model 3 (Tesla share May 2017: 41%, June 2018: 74%)
  -- Helps proliferate EV into more and more mainstream garages
  -- Inspiration to mainstream OEMs – the next, next wave of EVs
- Impact of multiple new 220-250-mile EVs (Kona EV, Niro EV, Soul EV, Leaf, Model 3)
  -- Will significantly advance EV adoption
  -- More Mainstream appeal
- Who is buying EVs now vs. 2-years ago?
- Transaction price trends
- Geographical trends – are EV sales expanding beyond initial ("traditional" markets like CA, NY, OR, etc.)

Organizers:
Jim Alvis- KIA, email: jimalvis@kia-dc.com
Mike Safoutin – EPA , email: safoutin.mike@epa.gov
DOE –

3) Electric Drive Part 2 – Infrastructure

This session will look at the economics and business case in deploying a low carbon infrastructure.

Organizers:
John Eichberger - Fuels Institute, email: [HYPERLINK "mailto:jeichberger@fuelsinstitute.org"]
DOE, –
EPA

4) Fuels

Most vehicles on the road today are powered by liquid fuels, and forecasts project liquid fuel-powered internal combustion engines will continue to be in the market for the next several decades. This session will explore the roles of liquid fuels for light-duty vehicles.
Need to include discussion of fuel retailers' perspective and possibly include lubricants and advanced lubricants.

Organizers:
Patrick Kelly – API, email: kellyp@api.org
John Eichberger - Fuels Institute, email: jeichberger@fuelsinstitute.org
DOE –

EPA -

5) **<u>Heavy-Duty Vehicles Part 1. Technologies</u>**

6) **<u>Heavy-Duty Vehicles Part 2. Infrastructure & Fuels</u>**

This two-part session will explore HD topics:
Driving efficiencies in Freight Trucks

- Electric Vehicle OEMs, Truck OEMs
- Autonomous, platooning
- Supertruck
- Geofencing
- Hybridization, Fuel Cells, Renewable fuels
- Fleets' perspective

Organizers:
Industry: Allen Schaeffer - Diesel Technology Forum, email: aschaeffer@dieselforum.org
DOE: Ken Howden – DOE, email: ken.howden@ee.doe.gov
EPA:

7) **<u>Chemical Activities Impacting the Automotive Industry- *Panel session*</u>**

This panel session will discuss new State initiatives covering Lithium Ion, Lead Acid batteries, Zinc in tires, vehicle fluid leaks and others, as well as, Federal certification and compliance topics that may affect OEM & suppliers' decisions on material, engineering and manufacturing choices.

Organizers:
Laurie Holmes (MEMA); email: LHolmes@mema.org
Dan Selke (MBUSA); email: [HYPERLINK "mailto:daniel.selke@mbusa.com"]

8) **<u>Will this session be part of the Pleanry? Global State of Transportation and Air Quality both US and Abroad- *Panel Session*</u>**

This session will examine the current status, consumer response, and potential trends of transportation policies being implemented or considered in some of the most influential markets around the world and assess their potential overall impact on the global vehicles market.

Organizers:
William Chernicoff- Toyota, email: william.chernicoff@toyota.com
Industry: John Eichberger - Fuels Institute, email: jeichberger@fuelsinstitute.org
EPA:

~~*9)* **Data Analytics for Improving Vehicle Efficiency and Emissions –** *Do we want to keep this session or consolidate with the new sessions?*~~

~~This session will explore how the automotive industry is using "big data" and how it can be used in the future to inform/transform transportation policy. Topics will cover energy and the environment issues such as: - Manufactures use of data for improving vehicle design for efficiency and environment - Vehicle service prognostics and diagnostics - Helping I/M programs, etc....~~

~~**Organizers:**~~ **Consolidate to new sessions.**

9) **<u>New mobility – Technologies (Autonomous Vehicles)</u>**

The session will discuss the current state of research and discuss the policy and how regulations may impact this growing mode of transportation. What might the future of this technology look like.

Organizers:
Comment about this being a panel session or the other new sessions?

10) *NEW Session:* **<u>New mobility – Emerging Personal Mobility Options</u>**

Topics including: Hyper loop, bike sharing, ride sharing all affecting emissions, urban planning, Smart Cities and Nevada Smart Communities transportation systems, etc....

Organizers:

11) *NEW Session:* **<u>New Mobility – Freight movement/ E-Commerce</u>**

Topics including: E-Commerce, grocery and goods delivery, etc.... This session will explore the opportunities and risks of an E-Commerce world looking at both energy and environmental implications including international trade impacts. Possibly combine with Safety?
Organizers:

Appointment

From: Tanman, Arman [Tanman.Arman@epa.gov]
Sent: 9/27/2018 7:23:59 PM
To: jimalvis@kia-dc.com; william_chernicoff@tma.toyota.com; dgreenhaus@nada.org; hillebrand@anl.gov; tom.hollowell@wthconsulting.com; ken.howden@ee.doe.gov; ken.katz@dot.gov; kellyp@api.org; james_kliesch@ahm.honda.com; jrege@globalautomakers.org; aschaeffer@dieselforum.org; sschmidt@autoalliance.org; michael.d.scott@daimler.com; sluders@ornl.gov; smithrl4@ornl.gov; stephane.thiriez@na.mitsubishi-motors.com; whwalshjr@aol.com; Colette.Wright@sae.org; Robert_Wimmer@toyota.com; william.chernicoff@toyota.com; STatman@autoalliance.org; robert.wimmer@toyota.com; lholmes@mema.org; jeichberger@fuelsinstitute.org; William.Craven@daimler.com; patricia.strabbing@fcagroup.com; daniel.selke@mbusa.com; nadir.yilmaz@howard.edu; mjena@sae.org; Marc.LeDuc@sae.org; Simon, Karl [Simon.Karl@epa.gov]; stephen.summers@dot.gov; 'Peter.Martin@dot.gov'; Machiele, Paul [machiele.paul@epa.gov]; Ezra Finkin [efinkin@dieselforum.org]; Martin, Peter (NHTSA [Peter.Martin@dot.gov]; Melissa Jena [Melissa.Jena@sae.org]; Vickie and Tom Hollowell [tvhollowell@gmail.com]

Subject: 2019 SAE G/I Environment & Energy Sessions Planning Meeting follow-up
Attachments: 2019 SAE GI -EE Session Ideas Ver.5.docx
Location: Conference Call in number: Ex. 6 Personal Privacy (PP)

Start: 10/3/2018 6:00:00 PM
End: 10/3/2018 7:00:00 PM
Show Time As: Tentative

Required Attendees: jimalvis@kia-dc.com; william_chernicoff@tma.toyota.com; dgreenhaus@nada.org; hillebrand@anl.gov; tom.hollowell@wthconsulting.com; ken.howden@ee.doe.gov; ken.katz@dot.gov; kellyp@api.org; james_kliesch@ahm.honda.com; jrege@globalautomakers.org; Allen Schaeffer; sschmidt@autoalliance.org; michael.d.scott@daimler.com; sluders@ornl.gov; smithrl4@ornl.gov; stephane.thiriez@na.mitsubishi-motors.com; whwalshjr@aol.com; Colette.Wright@sae.org; Robert_Wimmer@toyota.com; william.chernicoff@toyota.com; STatman@autoalliance.org; robert.wimmer@toyota.com; lholmes@mema.org; jeichberger@fuelsinstitute.org; William.Craven@daimler.com; patricia.strabbing@fcagroup.com; daniel.selke@mbusa.com; nadir.yilmaz@howard.edu; mjena@sae.org; Marc.LeDuc@sae.org; Simon, Karl; stephen.summers@dot.gov; 'Peter.Martin@dot.gov'; Machiele, Paul; Ezra Finkin; Martin, Peter (NHTSA; Melissa Jena; Vickie and Tom Hollowell

Conference Call in number: Ex. 6 Personal Privacy (PP)

Hi Environmental and Energy Sessions planning group,
Attached it the latest list of sessions based on our discussion at our committee meeting and follow up emails. On this list there are 10 sessions (possibly 11) and our aim for this conference call is to identify some more organizers and clarify the session descriptions.

The next general committee meeting is scheduled for October 11, where Melissa would like our session descriptions, identify the organizers and schedule the sessions. In preparation for that I am sending out this meeting notice. If you cannot make it, please sends us your thoughts on the sessions, additional description and or possible organizers for the sessions and I can add it to the session ideas document before our call.
Thanks for all your help,
Arman

Arman Tanman
Mechanical/Environmental Engineer
U.S. Environmental Protection Agency
Office of Transportation and Air Quality

Transportation and Climate Division, Technology Assessment Center (6406A)
1200 Pennsylvania Ave., N.W.
Washington, D.C. 20460
(202) 343-9326 phone

DRAFT
Environmental and Energy Sessions for 2019 SAE G/I Meeting

1) **Light Duty GHG/CAFE**

This session examines the latest analytic and policy implications to light duty CAFE and GHG standards. Government, industry and policy leaders will share recent findings, and provide perspective on both the ongoing and the post-2025 regulatory environment.

Organizers:

Laurie Holmes - MEMA; email: [HYPERLINK "mailto:LHolmes@mema.org"]
Jim Kliesch - Honda, email: [HYPERLINK "mailto:james_kliesch@ahm.honda.com"]
Kevin Bolon – EPA, email: [HYPERLINK "mailto:Bolon.kevin@Epa.gov"]
Ken Katz – NHTSA, email: [HYPERLINK "mailto:ken.katz@dot.gov"]

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This session will cover the global trends in EV:

- What are the policies driving these trends? (To include recent development in U.S. policy on fuel economy standards/rollback).
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- Impact on EV Market, moving forward
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  -- Inspiration to mainstream OEMs – the next, next wave of EVs
- Impact of multiple new 220-250-mile EVs (Kona EV, Niro EV, Soul EV, Leaf, Model 3)
  -- Will significantly advance EV adoption
  -- More Mainstream appeal
- Who is buying EVs now vs. 2-years ago?
- Transaction price trends
- Geographical trends – are EV sales expanding beyond initial ("traditional" markets like CA, NY, OR, etc.)

Organizers:
Jim Alvis- KIA, email: jimalvis@kia-dc.com
Mike Safoutin – EPA , email: safoutin.mike@epa.gov
DOE –

3) **Electric Drive Part 2 – Infrastructure**

This session will look at the economics and business case in deploying a low carbon infrastructure.
Organizers:
Industry - Amanda Applebaum- Fuels Institute, email: aappelbaum@fuelsinstitute.org
DOE -
EPA -

4) **Fuels**

Most vehicles on the road today are powered by liquid fuels, and forecasts project liquid fuel-powered internal combustion engines will continue to be in the market for the next several decades. This session will explore the roles of liquid fuels for light-duty vehicles.
Need to include discussion of fuel retailers' perspective and possibly include lubricants and advanced lubricants.

Organizers:
Patrick Kelly – API, email: kellyp@api.org
John Eichberger - Fuels Institute, email: jeichberger@fuelsinstitute.org
DOE –
EPA -

5) **Heavy-Duty Vehicles Part 1. Technologies**
6) **Heavy-Duty Vehicles Part 2. Infrastructure & Fuels**
This two-part session will explore HD topics:
Driving efficiencies in Freight Trucks
- Electric Vehicle OEMs, Truck OEMs
- Autonomous, platooning
- Supertruck
- Geofencing
- Hybridization, Fuel Cells, Renewable fuels
- Fleets' perspective

Organizers:
Industry: Allen Schaeffer - Diesel Technology Forum, email: [HYPERLINK "mailto:aschaeffer@dieselforum.org"]
Amanda Applebaum- Fuels Institute, email: aappelbaum@fuelsinstitute.org
DOE: Ken Howden – DOE, email: ken.howden@ee.doe.gov
EPA:

7) **Chemical Activities Impacting the Automotive Industry- *Panel session***
This panel session will discuss new State initiatives covering Lithium Ion, Lead Acid batteries, Zinc in tires, vehicle fluid leaks and others, as well as, Federal certification and compliance topics that may affect OEM & suppliers' decisions on material, engineering and manufacturing choices.
Moderator: Maureen Gorsen (Alston & Bird)
Organizers:
Laurie Holmes (MEMA); email: LHolmes@mema.org
Dan Selke (MBUSA); email: [HYPERLINK "mailto:daniel.selke@mbusa.com"]

8) **New mobility – Technologies (Autonomous Vehicles)**
The session will discuss the current state of research and discuss the policy and how regulations may impact this growing mode of transportation. What might the future of this technology look like.
Organizers:
Industry - Rini Sherony (Toyota); email: [HYPERLINK "mailto:rini.sherony@toyota.com"] ? (awaiting confirmation)
Government -

9) *NEW Session:* **New mobility – Emerging Personal Mobility Options**
Topics including: Hyper loop, bike sharing, ride sharing all affecting emissions, urban planning, Smart Cities and Nevada Smart Communities transportation systems, etc….
Organizers:
Industry -
Government -

10) *NEW Session:* **New Mobility – Freight movement/ E-Commerce**
Topics including: E-Commerce, grocery and goods delivery, etc…. This session will explore the opportunities and risks of an E-Commerce world looking at both energy and environmental implications including international trade impacts. Possibly combine with Safety?
Organizers:
Industry -
Government –Cheryl Bynum – EPA; email; bynum.cheryl@epa.gov

11) **<u>? Will this session be part of the Plenary? Global State of Transportation and Air Quality both US and Abroad- *Panel Session*</u>**

This session will examine the current status, consumer response, and potential trends of transportation policies being implemented or considered in some of the most influential markets around the world and assess their potential overall impact on the global vehicles market.

Organizers:

William Chernicoff- Toyota, email: william.chernicoff@toyota.com
Industry: John Eichberger - Fuels Institute, email: jeichberger@fuelsinstitute.org
EPA:

Message

From: Burke, Susan [Burke.Susan@epa.gov]
Sent: 12/21/2018 6:05:49 PM
To: Simon, Karl [Simon.Karl@epa.gov]
CC: Snapp, Lisa [snapp.lisa@epa.gov]
Subject: BW Briefing on EVs (currently scheduled for Jan 9)
Attachments: EV Brownbag_4.4.18.pptx

Hi Karl,

Here is the current outline for our briefing with Bill Wehrum. I plan to be back on the 2nd, and will be ready to pull the draft together quickly so you and other managers can review it by the end of that week. I've reached out to everyone noted below and don't anticipate any timing issues with receiving materials from them.

In case it's helpful, attached is a brownbag presentation that Aaron Hula and I pulled together earlier this year. I plan to draw from that (with updates) for the first 10 to 15 of the upfront slides.

Have a good holiday!
Susan

Draft outline for AA briefing

Electric Vehicle Market (see attached brownbag)

- U.S. sales
- Status of new & future vehicle rollouts
- Global market (China...)
- Market drivers: Battery cost reductions, international targets/policies, state policies, incentives

Infrastructure (see attached brownbag)

- Types of charging; how and where people charge
- Status of current & planned public infrastructure
- NREL assessment on U.S. charging infrastructure needs
- Utility role/grid interactions
- Infrastructure challenges
- Charging stations at NVFEL – [Info from Ruth Schenk]

VW Partial Settlements

- Appendix C
  - Structure/requirements
  - EPA's role (OECA lead, self-implementing)
  - Cycle 1 highlights
  - Cycle 2 status
- Appendix D – [Christine Koester]
  - Structure—eligible electrification projects
  - State plans for LD charging infrastructure & EV acquisitions

OTAQ EV-related Activities (1 or 2 slides each)

- EV Test Procedures for Labeling [CD--David Wright]
  - FE Label & consumer information
  - TATD EV Testing Activities [Dan/Arlene]
- ASD work on technology trends/costs [pulling from Mike Safoutin talk]
- Other EV-grid modeling (high-level mentions of GCAM, eGRID, IPM, UC Davis work)

- CD fuels program: RFS for electricity as transportation fuel [Barbora Master]
- Voluntary programs: DERA, Ports Initiative [Faye, Sarah F]
- Working with federal partners (DOE, DOT/FHWA)

> -----Original Message-----
> From: Simon, Karl
> Sent: Monday, December 10, 2018 3:59 PM
> To: Charmley, William <charmley.william@epa.gov>; Haugen, David <haugen.david@epa.gov>; Bunker, Byron <bunker.byron@epa.gov>
> Subject: Briefing for bill W
>
> After a discussion with Chris last week, we are scheduling a briefing with Bill for early January to give an overview briefing on electrification efforts. This will cover a range of issues including upcoming vehicle model intros, infrastructure investments, etc. It will also highlight key OTAQ efforts in this area. The briefing is meant to be a cross office one. I asked Susan Burke to start pulling together info for us and we will take a shot at integrating info in a larger office briefing. Start thinking about what you want to present and let me know who your point person on this will be. Thx

Message

From: Blubaugh, Jim [Blubaugh.Jim@epa.gov]
Sent: 4/30/2019 3:03:57 PM
To: Simon, Karl [Simon.Karl@epa.gov]
Subject: Last OTAQ-ECCC Workplan
Attachments: ECCC-EPA Strategic Work Plan on Vehicles Engines and Fuels for 2017-2018 (Final).docx

Last OATQ-ECCC Workplan is attached for your perusal.

-Jim

Message

From: Bynum, Cheryl [bynum.cheryl@epa.gov]
Sent: 6/17/2019 11:59:28 AM
To: Nelson, Brian [nelson.brian@epa.gov]; Burke, Susan [Burke.Susan@epa.gov]
CC: Simon, Karl [Simon.Karl@epa.gov]
Subject: FW: Synthesis-Draft Truck Electrification Session at Movin'On
Attachments: MOS19_NACFE-Michelin-FINAL.pptx

I recently participated the Movin' On sustainable mobility conference in Montreal, where I took part in a three part workshop on battery electric/fuel cell in commercial trucking. The focus was on what we could be doing now to accelerate either battery or fuel cell in commercial trucking by 2030. Attached are notes from the workshop. I invite you to review and comment, and share with others as is helpful (please don't share outside of EPA however at this time). If you could provide feedback within a week or so, that would be helpful (by June 25th)

Thank you,

Cheryl

From: Robert Radulescu <robert.radulescu@michelin.com>
Sent: Friday, June 14, 2019 4:35 PM
To: Mike Roeth <mike.roeth@nacfe.org>; crayner@ups.com; Bynum, Cheryl <bynum.cheryl@epa.gov>; Sengupta Raja <raja.sengupta@volvo.com>; ELLIS Matthew <Matthew.ELLIS2@3ds.com>; Francisco Gonzalez <franciscoj.gonzalez@metalsa.com>; Natalia Andrea Navarrete Alzate <natalia.navarrete@metalsa.com>; Pollock, Brian <brian.pollock@siemens.com>; sdasgupta@electrovaya.com; Mace, Alan <alan.mace@ballard.com>; Pierre-Yves LE-BERRE <pierre-yves.le-berre@symbio.one>; Sabrine Skiker <S.Skiker@hydrogeneurope.eu>
Subject: Synthesis-Draft Truck Electrification Session at Movin'On

Hello Everybody,

As promised, I'm sending a draft synthesis of the 3 part working session conducted at Movin'On for heavy truck electrification. I would appreciate any feedback you can provide to reach consensus on the findings before publication on the Movin'On platform and presentation to the entities mentioned at the end of the document. Note that I would reach out to those interested when scheduling these presentations.

Thank you again for all your help.

Robert

Heavy Truck Electrification – Batteries & Infrastructure

We exchanged first on figures:

- 1 kg of Lithium-ion batteries (at the pack level) contains an energy of 100-265 Wh
- 1 kWh permits to drive 1.3 km (to be confirmed if it is for buses or 80k lbs trucks)
- To drive 500 km, 600 kWh are needed, hence 6 tons of batteries
- It would take 2 hours for rapid charging and 6 hours for normal charging

Mr DASGUPTA gave a range of 150 miles / 250 km for battery-electric buses currently commercialized.

In the next 10 years, a gain of density efficiency in Wh/kg by 50% is forecasted (at the cell level).

The 3 main road blocks for the development of battery-electric HD trucks:

- The scale-up of production including infrastructure deployment (European Union evaluates the need of energy to 900 GWh WW by 2025 with 1/3 for EU)
- The limitation of current technologies (fast charging, capacity)
- The rarefaction of raw materials (CO, Li, Ni) and the mandatory recycling capacities for an ethical and sustainable Supply Chain

The 3 main solutions to address the road blocks are related to:

- Increasing the energy density of cells by 50% by 2030
    - R&D intensive
    - Early commercialization
- Distributing manufacturing for a large scale production
- Creating the demand
    - Regulating (governments)
    - Marketing the technology

The gain in range is assessed at a factor 2:

- Range x2 at the same price
- Price /2 at the same range

Note that all the experts at the table (linked to battery business !) don't believe in hydrogen ; 2 main reasons were given:

- The very low efficiency of thermodynamics for electricity based on hydrogen (21% against 94% for batteries)
- The existing infrastructure for electricity already available everywhere enabling battery charging

Example of batteries for cars:

- Renault ZOE: 82 Wh/kg
- Bolloré BlueCar: 100 Wh/kg
- BMW I3: 95 Wh/kg
- Tesla Model S: 156 Wh/kg

Message

From: Moran, Robin [moran.robin@epa.gov]
Sent: 6/25/2019 8:16:49 PM
To: Charmley, William [charmley.william@epa.gov]
CC: Simon, Karl [Simon.Karl@epa.gov]; Snapp, Lisa [snapp.lisa@epa.gov]; Graff, Michelle [graff.michelle@epa.gov]; Jackman, Dana [jackman.dana@epa.gov]; Hoyer, Marion [hoyer.marion@epa.gov]; Helfand, Gloria [helfand.gloria@epa.gov]; Sobel, Aaron [Sobel.Aaron@epa.gov]; Lie, Sharyn [Lie.Sharyn@epa.gov]; Burke, Susan [Burke.Susan@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Sargeant, Kathryn [sargeant.kathryn@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Gonzalez, Gail [Gonzalez.Gail@epa.gov]
Subject: Material for STEPS Briefing - tomorrow (Wednesday), 1pm
Attachments: STEPS Spring Symposium highlights_May 2019_for Bill Charmley_06-26-2019.pptx

STEPS Spring
Symposium highl...

Hi Bill, we're looking forward to briefing you tomorrow on the STEPS symposium that Michelle, Aaron and I attended back in May. We had a chance to discuss this with Karl a couple weeks ago, and have also briefed the larger OTAQ SAEV team. Attached is the presentation.

Gail – can you please add a call-in # for the DC folks to join?

Thanks
Robin

Subject: STEPS Update Briefing for Charmley
Location: N158

Start: Wed 6/26/2019 1:05 PM
End: Wed 6/26/2019 1:55 PM

Recurrence: (none)

Meeting Status: Accepted

Organizer: Charmley, William
Required Attendees: Jackman, Dana; Simon, Karl (Simon.Karl@epa.gov); Robin Moran; Marion Hoyer; Gloria Helfand; Sobel, Aaron; Snapp, Lisa; Sharyn Lie; Graff, Michelle; Burke, Susan; Bolon, Kevin; Kathryn Sargeant (sargeant.kathryn@epa.gov); Michael Olechiw (olechiw.michael@epa.gov)

Categories: Bill meetings

UCDAVIS

STEPSPlus

Sustainable Transportation Energy Pathways

UC Davis STEPS Spring Symposium

May 15-16, 2019

HIGHLIGHTS FOR BILL CHARMLEY

JUNE 26, 2019

What is STEPS?

- Multidisciplinary research consortium to understand sustainable vehicle and energy solutions
- Brings together auto/truck OEMs, energy firms, new mobility companies, foundations, government
- 5 centers:

OTAQ funds
3 centers
($200k)

Plug-in Hybrid & Electric Vehicles Research Center

What is required for developing a sustainable market for electric vehicles?

3 Revolutions Future Mobility Program

How can the emerging technologies of automated, shared and electric vehicles be guided to a better future?

China Center for Energy and Transportation

What policies and business decisions can help speed the commercialization of zero emission vehicles and support environmental goals in the U.S. and China?

Energy Futures & Alternative Fuels Program

What do economic/environmental transportation/energy models tell us about the future of sustainable transportation? How do we hit key sustainability targets cost effectively? What policies are needed?

Sustainable Freight Research Center

What technologies, policies and strategies are needed to achieve sustainable trucking, supply chain management and urban freight transportation? What fuel transitions are practical for rail, shipping and Air?

Spring Symposium format

- Overviews of research in all 5 centers (1 ½ days)

- Deep Dives for each Center (1/2 day, last day)
  - OTAQ covered the 3 centers we're funding; Region 9 (John Mikulin) covered Sustainable Freight

- Poster presentations available on additional research

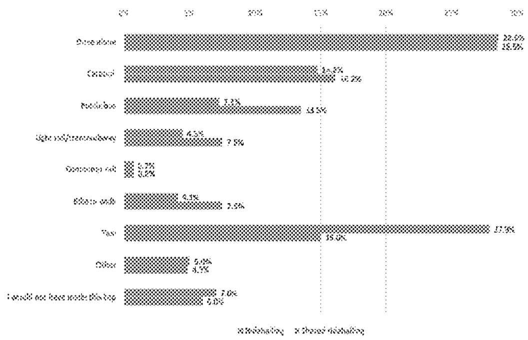
- Presentations available: https://steps.ucdavis.edu/stepsplus-spring-symposium-2019/ [password=steps]
  - 3Rs breakout session: https://ucdavis.app.box.com/s/m3i2jpslutvtgpenl7bi7kl0tz0u9xyc
  - EV/PHEV breakout session:

3Rs

- Overviews
  - Update on 3RFM Behavioral Studies (Giovanni Circella)
  - Insights from CA Mobility Survey (Farzad Alemi)
  - Micromobility and Dockless Bikesharing in the Sacramento Region (Dillon Fitch)
- Deep Dives
  - CA Mobility Survey
  - Pulse of the Nation
  - Designing AVs to Promote Ridepooling
  - Micromobility Research Activities & Plans
  - Mobility in the The Sustainable City (Dubai)
  - Lessons from AV Modeling Expert Group Meeting

3Rs – CA Panel Survey Highlights

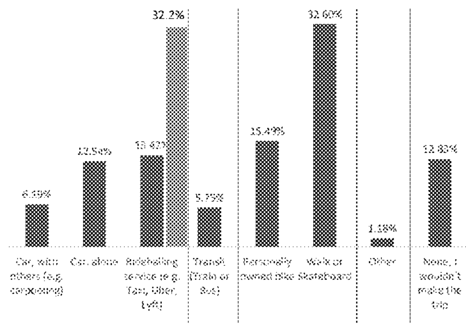
- Adoption and frequency of use nearly doubled from 2015 to 2018
- Most rides (≈86%) are still individual, not pooled
  - Biggest factor prevent pooling is unreliable travel time
  - Based on choice experiment, people still resistant to MaaS
    - But proposed options may have been inadequate/unrealistic
- 2018 survey added section asking about future mobility and propensity to AVs
  - Correlation between people in favor of transit and people interested in shared AVs
- In line with other studies, shared rides replace transit more than individual rides do; also replaces walking and biking
  - Individual rides replace driving alone and taxis
  - Mode substitution also depends on trip purpose and trip duration



3Rs – Other Studies

- Dockless Bikesharing
  - Bicycling*Plus* Research Collaborative
  - Bikesharing substituting for transit, and decreasing driving and ridehailing
  - 2nd wave of survey recently released; also includes questions about e-scooters
- AV Modeling Expert Group Meeting
  - White paper with summary of meeting and lessons learned should be out later this summer

JUMP Bikeshare Mode Substitution



3Rs - Studies In Progress/Development

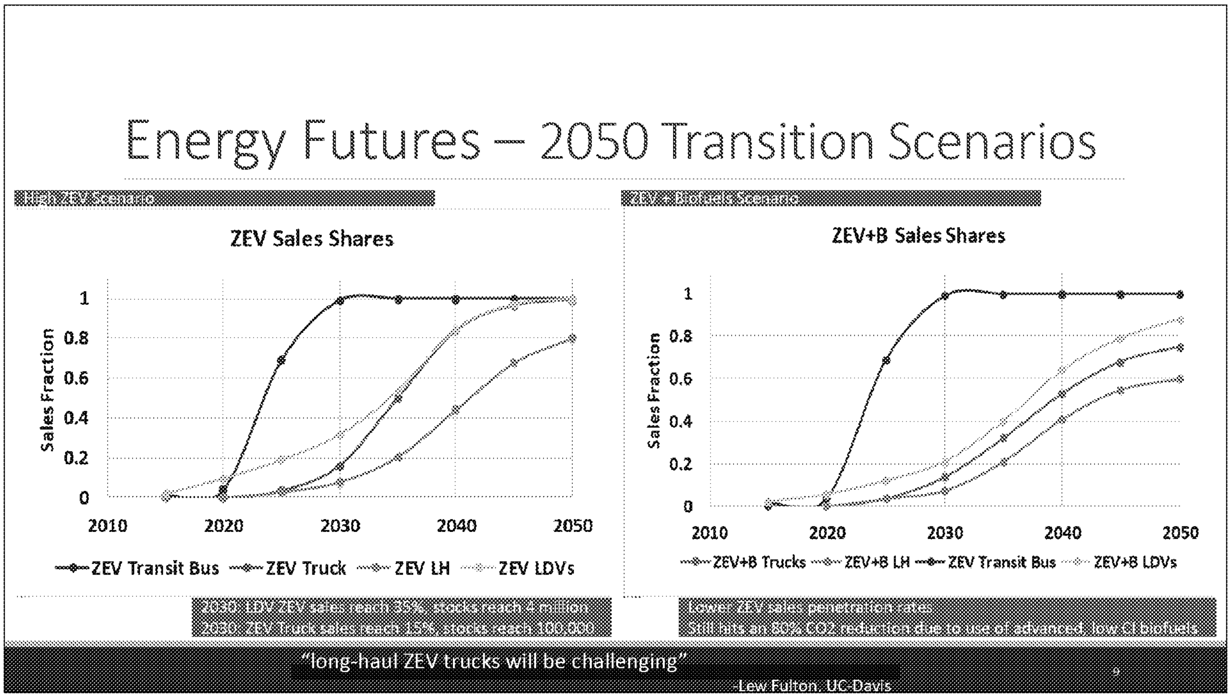
- Pulse of the Nation Study: expanding CA panel survey to 8 US cities (San Francisco, Los Angeles, Sacramento, DC, Boston, Seattle, Salt Lake City, and Kansas City)
  - Developing a MaaS subscription survey to assess viability
  - Annual data collection

- New mobility trends in southern, car-dependent cities (Phoenix, Atlanta, Tampa, Austin)
  - Collaborating with Georgia Tech, Arizona State University, University of South Florida, and UT Austin
  - GA Tech, ASU, USF are part of TOMNET (along with University of Washington), who may be another **potential research partner**
- Planning to launch a new micromobility panel survey across North America

Energy Futures

- Overviews
  - STEPS 2050 Transition Scenarios (Lew Fulton)
  - Energy "Presents" & "Recent Pasts" ...under (LCFS-like) policy incentives (Julie Witcover)
  - High Renewable Penetration in California Electricity Grid and the Role of ZEVs as Storage Devices: CalEV (Behdad Kiani)
- Deep Dives
  - CalEV Model Deep Dive (Behdad Kiani)
  - Biofuels - LCFS Impacts on Fuel Prices (Colin Murphy)
  - Global Electric Adoption Vehicle Modeling (Alan Jenn)

CalEV Model Deep Dive (Behdad Kiani)
Biofuels - LCFS Impacts on Fuel Prices (Colin Murphy)
Model developing to get to see the impacts of the LCFS credits
Looking to do open-source
Global Electric Adoption Vehicle Modeling (Alan Jenn)
Global vehicle modeling work to analyze consumer preferences and vehicle choice over time
53 major countries with focus on five major markets: US, China, Germany, France, UK
Looking out to 2040
Preliminary runs of their global EV modeling, informed by consumer choices and OEM options show US going all BEV by 2040 with no PHEVs
European countries get to 90% PEV with a high proportion of PHEVs
This dynamic seemed odd and when asked, it was simply driven by the trends in data so far - Alan Jenn



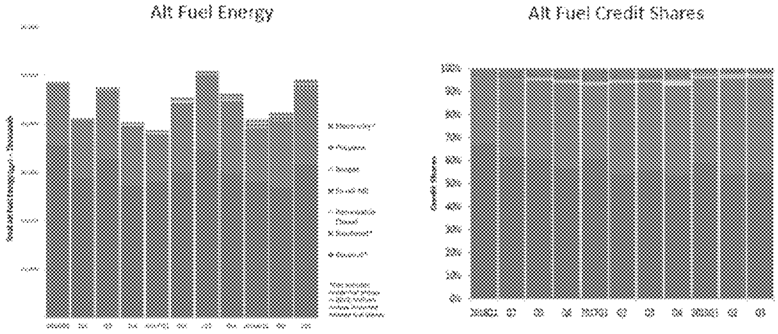
California Executive Order S-3-05: 80% below 1990 levels by 2050
Arnold’s goal
•The Transition scenarios, though focused on 80% CO_2 reduction in 2050, pass through 2030 points that are roughly consistent with some ZEV targets and at least one LCFS scenario
•The electricity use and battery capacity of vehicles in 2030 has some interesting implications relative to the broader electric generation picture
•The biofuels implications are not implausible, though for truly very low CI biofuels, reaching production and cost targets could be challenging
Researchers were surprised more biofuels weren’t needed

Energy Futures –
Energy “Presents” & “Recent Pasts”

Energy & Credits Generated Under Oregon LCFS Program

Alt Fuel Energy

Alt Fuel Credit Shares

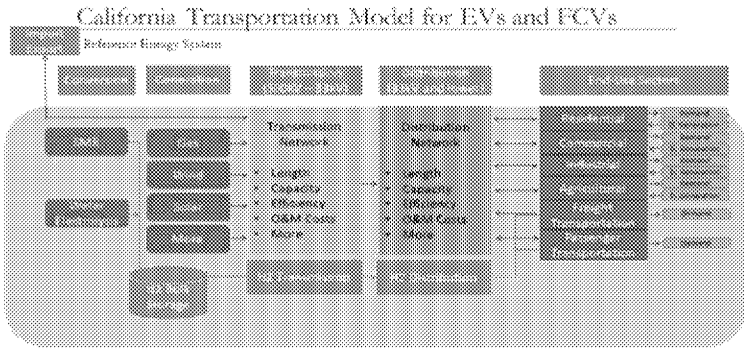


- Oregon LCFS program mostly generating credits from ethanol (blue) and biodiesel (green) to date
- State-by-state LCFS programs have potential to compete with each other – but are collectively lowering CI of fuels

Canada clean fuel standard under development, similar to LCFS, beyond transportation fuels, aiming to address ILUC
Colorado also looking to implement LCFS program

Energy Futures – CalEV Model for California

- Model under development by UC-Davis
- Built on MESSAGE platform
- Multisectoral, 5 geophysical regions in CA
- 8760 hours/year for California load
- Electricity grid capacity expansion ability
- Focused on transportation and fuels
  - Including electricity and hydrogen
- One purpose is to analyze variable renewable electricity and vehicle charging scenarios
  - Including V1G and V2G scenarios
  - Energy storage



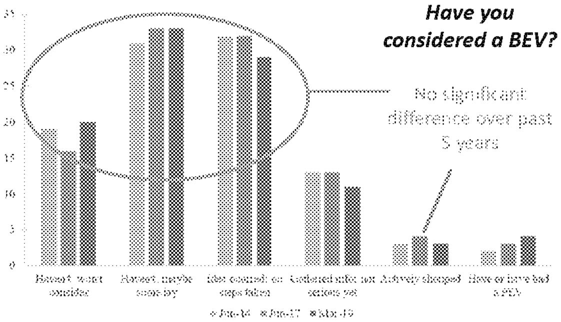
Initial findings for 2050 is that 100% variable renewable electricity would be possible, using energy storage
BEV batteries could provide 2.5x the energy storage needed for the day with the highest lack of renewable resources
Hydrogen storage for vehicle fuel use might work well for periods with shortage of renewable resources available

EV/PHEV

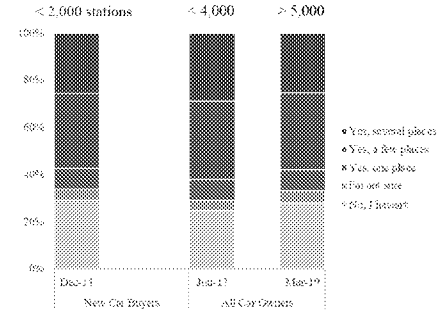
- Overviews
  - Utility factor and charging preferences of PHEVs (Gil Tal)
  - Demand drivers for charging infrastructure (Debapriya Chakraborty)
  - CA consumers and PEVs: a 2019 update (Ken Kurani)
- Deep-Dive
  - Potential solutions to the problem of consumer awareness of PEVs (Ken Kurani)
  - What do we know about partially automated vehicles (Scott Hardman)
  - Electric grid; transportation finance (Alan Jenn)
  - Spatial and temporal dynamics in the CA PEV market (Debapriya Chakraborty)
- UC Davis highlighted that they were making 9 presentations at the 32nd International Electric Vehicle Symposium (EVS32) in Lyon (May 20-22) – message is that they are very engaged with the global research community on EV issues

EV/PHEV: CA Consumers & PEVs (Kurani)

Consumer Consideration, 2014 to 2019, percent



Have you seen any electric vehicle charging spots in the parking garages and lots you use?



No significant difference in past 5 years. despite 2.5X increase in chargers

Kurani: If you're not invested/paying attention, you're not seeing chargers etc. (similar findings for knowledge of Fed/state tax incentives, can you name an EV, etc.). How to make people pay attention? Need to work on: how can EVs serve your needs?

EV/PHEV: Other Highlights

- **Utility Factor (UF) and Charging Preferences of PHEVs (Gil Tal)**
  - Observed UF lower than expected (~150 PHEVs), likely due to higher total VMT resulting in more gasoline-VMT (SAEJ2841 UFs based on 2001 NHTS)
  - Not clear yet what recommendations for UF changes; suggest we follow this one -- more data coming?
- **What do we know about partially automated vehicles (Scott Hardman)**
  - Is VMT increasing with autopilot? Study of Tesla autopilot (L2) usage
  - Yes: VMT increasing on weekends and with older drivers (70+); people more willing to drive in congestion
  - Next steps: 2018 CA survey of Tesla drivers just completed, 2019 survey with other OEMs vehicles, interviews w/users (qualitative)
- **Demand drivers for charging infrastructure (Debapriya Chakraborty)**
  - Cohort survey of CA PEV owners 2015-2017; 7 weekdays charging history (home/work/public/other)
  - Developed model of choice of charging location, based on expected drivers of choice decisions (e.g., availability of L2 home charging, free/paid work charging, commute distance, etc.)
  - Takeaways: pricing policies at home/work key in determining infra. demand; incentivizing L2 home installation & MUD chargers reduces need for work/public charging; consider longer-range PEVs (lower charging needs) in infrastructure planning
- **Transportation finance – State registration fees for EVs (Alan Jenn)**
  - ~16 states have imposed registration fees on EVs to make up gap in lost gas taxes
  - Interest fueled by oil industry-funded campaigns
  - STEPS exploring road user fees as alternative finance mechanism -- research ideas underway
- **EV extreme fast charging – environmental impacts (Alan Jenn)** [OTAQ funded project, not STEPS]
  - Jenn developed a new dispatch model "Grid Optimized Operation Dispatch" (GOOD) model, discussed pros/cons vs. IPM other existing models
  - Preliminary results show lower emissions from extreme fast charging (350kw+) vs. BAU case -- still assessing to understand why and regional/seasonal differences.

Sustainable Freight & China

Freight

- Transitions and challenges related to CARB ZEV regulation (Marshall Miller)
  - Interviews w/OEMs & fleets to understand their issues (focus on BEVs, not FCVs)
  - Issues: range, LCFS credits, TCO comparison (CARB uses 12 years, fleets say shorter), incentives, credits function of range, infrastructure available for fleets, education for fleets, etc.
  - White Paper in mid-June to CARB – suggestions to improve ZEV program

China

- Ride hailing developments in China (Fei Meng)
  - Didi = 90% market (merged w/Uber 2016) – provides the cars to Didi drivers; taxi + TNC use same platform; OEMs infiltrating market (BMW, Daimler, Geely). Work ongoing to compare China TNCs to CA/US.
- Optimal range of PHEV in Beijing and Shanghai (Yan Xing)
  - Odometer data ~40k ICEs Beijing + ~5k PHEVs Shanghai
  - Findings: 183 km (113 mi) and 350km (217 mi) range BEV can meet 90% and 99% of daily travel needs on average
- China's vehicle population and ZEV growth projection (Xiuli Zhang)
  - Forecasts range from 90% ZEVs by 2030s (tech diffusion model) to 40% ZEVs by 2040s (consumer choice model)
  - Shenzhen case study of aggressive EV growth (100% buses, 93% taxis, 15% logistics) could expand to other cities

Transportation Electrification in Shenzhen

End of 2018	EV	Fleet	EV/Total (%)	Nation wide
Bus	16,539	16,539	100%	37.8%
Taxi	20,135	21,689	92.84%	<10%
Logistic	41,051	283,054	14.3% (Aug 2018)	<5%

All buses have been switched over to EVs in Shenzhen
Almost all taxis have been electrified

Why is Shenzen such a hotbed for all-in on EVs?
Air quality was horrible here
BYD is based in this province
More than 95% of the world's electric buses are currently operating in China today
China is the largest oil importing nation with 71% of total oil consumed coming from foreign sources

Research Needs for Policy Priorities

- Dan Sperling: "we bring science to policy"
- "Big Idea" to reach 5 million ZEVs by 2030
  - Keep ZEV incentives in place until reach cost parity w/ICEs (~mid-2020's for sedans?)
  - Public awareness remains key (e.g., Veloz campaign, Electrify America commercials)
  - CARB staff suggested research on what can OEMs do to sell EVs better
- CARB reorganization: "Sustainable Transportation & Communities" (Annalisa Schilla, CARB)
  - Community support aligned w/climate goals & promote mobility innovation/economic opportunity
  - E.g., provide good jobs for ZEVs, new mobility workforce, coordinate mobility & housing strategies to reduce VMT and emissions, shift to clean + high-occupancy travel modes, etc.
- Policy Landscape for ITS-Davis research (Colin Murphy)

Common Threads & Key Takeaways

- Continued focus on consumer behavior, demand, incentives is needed.
- Equity needs to be considered everywhere.
- Market forces matter, need better tools to evaluate these.
- (Almost) everything has a spatial component.
- The portfolio approach is tilting towards ZEVs, but still significant gaps where other approaches are needed.
- Probably hard to meet near & mid term targets unless we get bioenergy & biofuels right.

Ex. 5 Deliberative Process (DP)

Ex. 5 Deliberative Process (DP)

Message

From: Snapp, Lisa [snapp.lisa@epa.gov]
Sent: 6/19/2019 7:50:52 PM
To: Simon, Karl [Simon.Karl@epa.gov]
Subject: New Mobility reading for Sarah
Attachments: UC Davis STEPs+ 3Rs projects March 2019.pdf; UC Davis STEPs+ EF projects March 2019.pdf; UC Davis STEPs+ PH&EV projects March 2019.pdf; Wadud - Carbon Impacts of AVs.pdf; APTA-Shared-Mobility.pdf; Asilomar_Agenda_6-11-19.pdf; Burke - Electric Vehicles & Charging Infrastructure Briefing (3.4.19).pptx; DOE EEMS presentation January 2017.pdf; Greenwald - AV policies.pdf; Hula - 2017 SAEV presentation.pptx; Johnson - Peak car ownership.pdf; Schaller - Automobility.pdf; Simon - 2017 AVS presentation.pptx; Simon - Can transportation emission reductions be achieved autonomously.pdf; UC Davis 3Rs Book - National Policy Options.docx

Message

From: Burke, Susan [Burke.Susan@epa.gov]
Sent: 8/21/2019 5:47:09 PM
To: Simon, Karl [Simon.Karl@epa.gov]
CC: Snapp, Lisa [snapp.lisa@epa.gov]; Hula, Aaron [Hula.Aaron@epa.gov]; Cleveland, Meredith [Cleveland.Meredith@epa.gov]
Subject: Materials for Thursday 11 AM Briefing on SAEVs
Attachments: Pre-Brief on CASC's Analytical SAEVs Work.pptx

Hi Karl,

Please find materials attached for our pre-brief tomorrow at 11 AM.

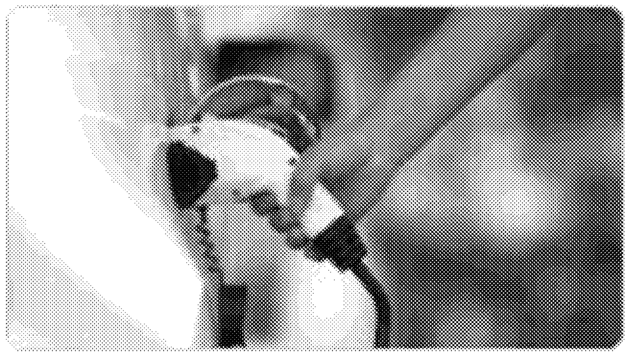
Thanks,
Susan

ANALYTICAL WORK ON FUTURE MOBILITY: SHARED, AUTONOMOUS, ELECTRIC VEHICLES (SAEVS)

DRAFT BRIEFING FOR SARAH DUNHAM

OVERVIEW

- Why study SAEVs?
- Recent & Upcoming Projects
  - Electric Vehicles & Charging Infrastructure
  - Autonomous Vehicles
  - Shared Mobility
- Publications, Technical Reviews, Conferences



WHY STUDY SAEVS? TRANSPORTATION IS CHANGING

LYFT SAYS IT WILL PROVIDE 1 BILLION RIDES PER YEAR USING ELECTRIC, AUTONOMOUS VEHICLES BY 2025

"GM believes in an all-electric future…"
Doug Parks, GM vice president of autonomous and electric vehicle programs, Jan 2019

"At Waymo, we've driven more than 10 million miles in the real world, and over 10 billion miles in simulation" (Techcrunch, July 2019)

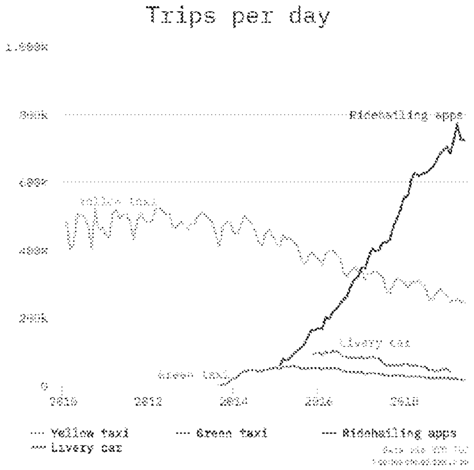
With Shell's Acquisition Of Greenlots, Big Oil Extends Its Reach Into EV Infrastructure (Forbes, Jan 2019)

City planners eye self-driving vehicles to correct mistakes of the 20th-century auto (Washington Post, July 2019)

"We talked about a huge investment in electric vehicles. We have 16 models that are in design and development. We have a pretty big surprise coming next year." Jim Hackett, Ford CEO, Jan 2019

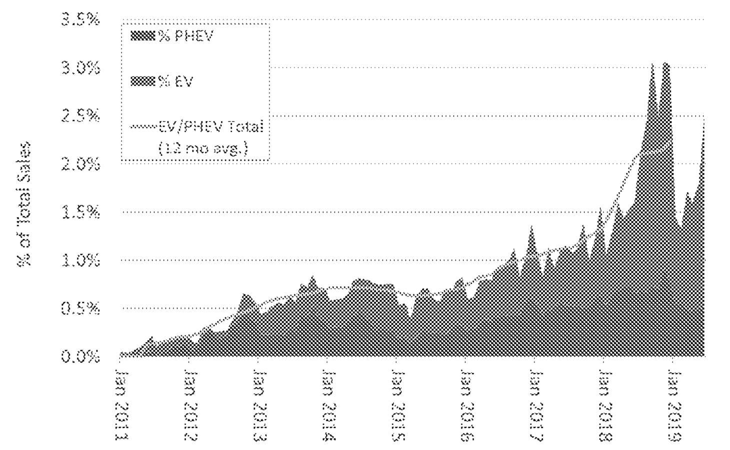
Sources:
https://media.gm.com/media/us/en/gm/home.detail.html/content/Pages/news/us/en/2019/jan/0109-charging.html
https://www.forbes.com/sites/lianeyvkoff/2019/01/31/with-shells-acquisition-of-greenlots-big-oil-extends-its-reach-into-ev-infrastructure/#654b872a6372
https://www.cnbc.com/2019/01/13/ford-ceo-says-a-big-surprise-coming-next-year-with-electric-vehicles.html

CHANGE IS ALREADY HAPPENING: THE RAPID GROWTH OF SHARED MOBILITY



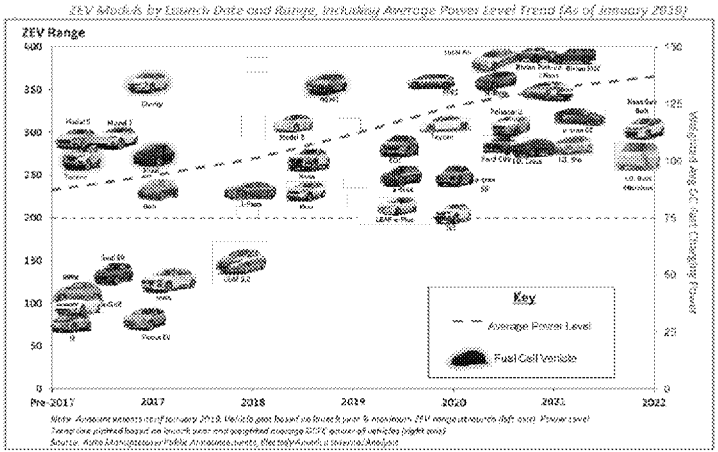
- Trips through shared mobility already far outpace traditional taxis in places like New York City
- Uber completes about 15 million trips per day and Didi Chuxing completes around 30 million trips per day
- Shared mobility is already likely impacting taxis, public transit ridership, urban traffic, travel patterns, etc.

CHANGE IS ALREADY HAPPENING: ELECTRIC VEHICLES ARE CAPTURING INCREASED MARKET SHARE



- EV/PHEV sales have increased for **15 straight quarters** (compared to the same quarter in previous years)
- Rapid decline in battery costs (~80% reduction since 2010) is a market driver
- EV/PHEV sales surpassed 2% of the total market in late 2018, driven by the Tesla Model 3
- However, Tesla (and GM) tax credits are now being phased out

AND MANY MORE MODELS COMING…



- **40+ EVs and PHEVs available today**
- **Automakers are increasing electric options,** e.g.,
  - Ford: 16 EVs by 2022 (+ 24 hybrid or plug-in hybrid models)
  - GM: 20 EVs by 2023
- **EV range—miles on a full battery—is growing**
- **Faster charging also on the way** (as cars become capable of accepting higher power)

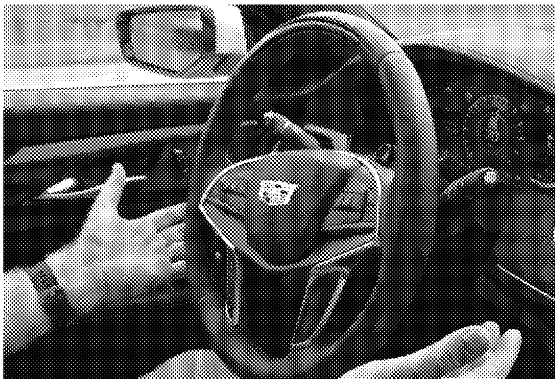
6

Source: Electrify America

Sources:
Graphic from Electrify America, available at: https://www.epa.gov/enforcement/epa-approved-national-zev-investment-plan-cycle-2-public-version

Other sources:
https://graphics.reuters.com/AUTOS-INVESTMENT-ELECTRIC/010081ZB3HD/index.html
https://www.gmsustainability.com/_pdf/downloads/GM_2017_SR.pdf
https://www.energy.gov/eere/vehicles/articles/fotw-1064-january-14-2019-median-all-electric-vehicle-range-grew-73-miles

CHANGE IS ALREADY HAPPENING: THE RISE OF AUTOMATED VEHICLE TECHNOLOGIES



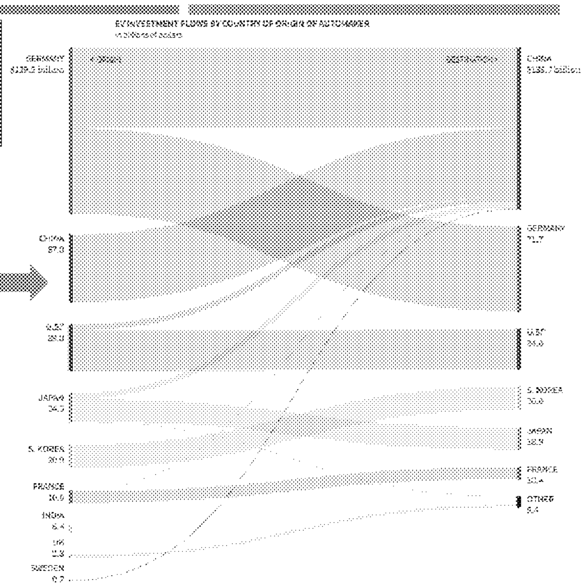
- Many manufacturers are introducing automated vehicle technology today including:
  - Hands free adaptive cruise control
  - Lane departure assist
  - Automatic braking and crash avoidance
- These vehicles are not fully automated
  - Level 2 or 3 out of 5 (SAE scale)
- Manufacturers have approached EPA repeatedly about testing and certification of fully autonomous vehicles.

FOLLOW THE MONEY

- Traditional manufacturers are making massive investments in electric vehicles, automated technologies, and shared mobility
  - $300B over the next 5–10 years into electrification
- Investors have been looking towards new mobility companies over traditional manufacturers

New Mobility Companies - Market Capitalization $B		
Amazon	$	980
Apple	$	957
Uber	$	74
Tesla	$	46
Lyft	$	19

Traditional Manufacturers - Market Capitalization $B		
Toyota	$	216
VW	$	90
GM	$	58
Honda	$	48
Ford	$	41



Source: Reuters

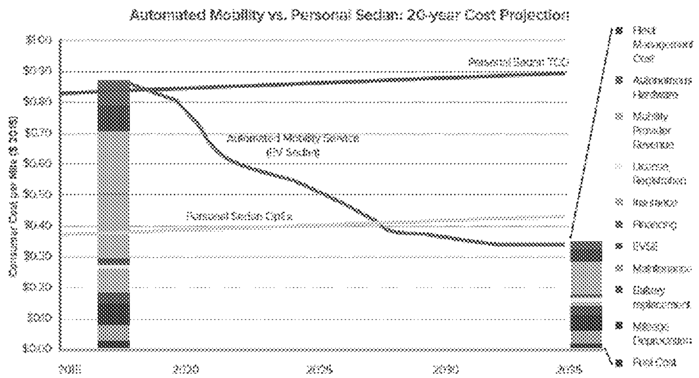
8

Sources:
https://graphics.reuters.com/AUTOS-INVESTMENT-ELECTRIC/010081ZB3HD/index.html
https://www.reuters.com/article/us-autoshow-detroit-electric-exclusive/exclusive-vw-china-spearhead-300-billion-global-drive-to-electrify-cars-idUSKCN1P40G6
https://www.reuters.com/article/us-autoshow-detroit-startups-electric-an/corporate-investors-pile-into-electric-vehicle-startups-idUSKCN1P52DC

Overall R&D budget:
https://autoalliance.org/innovation/
[Global automakers spent ~$109B in 2017.]
https://www.strategyand.pwc.com/media/file/2018-Global-Innovation-1000-Fact-Pack.pdf
[Graph on p.28 shows auto R&D between $99B and $109B from 2012–2017.]
For context, overall auto R&D spending has been about $100B/yr in recent years (PwC, Auto Alliance)

$300 Billion in EVs and Batteries
Investment by 29 global automakers over 5–10 yrs
Almost half ($136 Billion) is targeted to China
Germany, led by VW, is biggest source of investment
3x higher than the $90B global automakers had announced a year earlier

WHY YOU MIGHT NOT BUY ANOTHER CAR



- Shared, automated, and electric technologies are all developing at the same time and will likely complement each other
- SAEVs could be **safer**, reducing the 40,000 annual deaths in the US, and more than 1,000,000 annual deaths worldwide
- SAEV trips could be **cheaper** than taking a car you already own out of the garage!
- Overall environmental impact = TBD!!!

Source: Peak Car Ownership (Rocky Mountain Inst.)

ELECTRIC VEHICLE & INFRASTRUCTURE PROJECTS

EMISSIONS MODELING

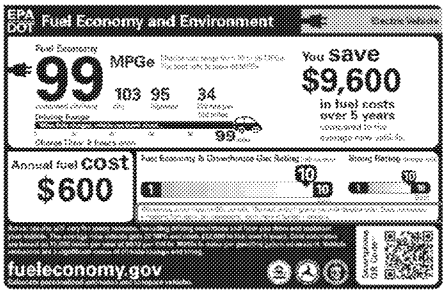
What are the emissions impacts from charging today or in the next 10–15 years?

- Existing tool on fueleconomy.gov for consumers
- Ongoing work with OAP; could inform state and local planners

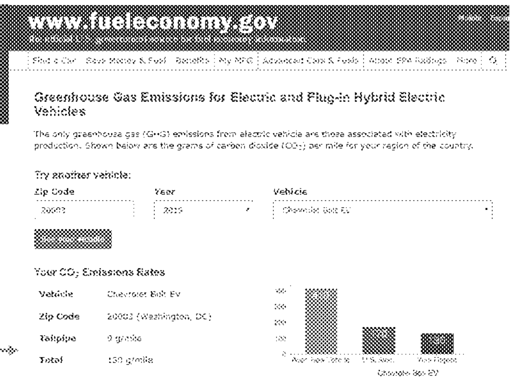
How could emissions change under future grid & charging scenarios?

- 2050 scenario analyses with OAP, ORD, & CEMC
- Extreme fast charging study

ELECTRIC VEHICLE EMISSIONS TODAY



For consumers: EV/PHEV calculator on fueleconomy.gov



- Provides regional CO_2 estimates for charging and driving any EV or PHEV in U.S. market
  - Zip-code matched to one of 26 eGRID regions
  - Upstream factors from GREET
  - Provides comparison to emissions from an average gasoline vehicle

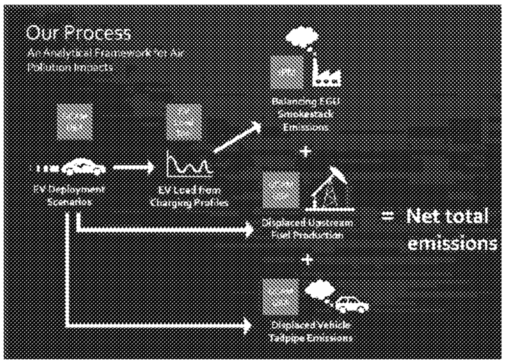
EV EMISSIONS MODELING NEXT 10–15 YEARS

- Joint OAP-OTAQ project to better understand both criteria and carbon impacts of EVs at the regional level
  - Series of ~100 IPM runs over different regions, times of day, weekdays vs weekends, and seasons
- **Why?**
  - As the EV market grows, we need a more complete picture of the emissions impacts including criteria pollutants like NOx
  - Robust series of IPM runs will identify which factors drive emissions impacts at the regional level, and how the time-of-day that charging occurs impacts results

Who is asking?

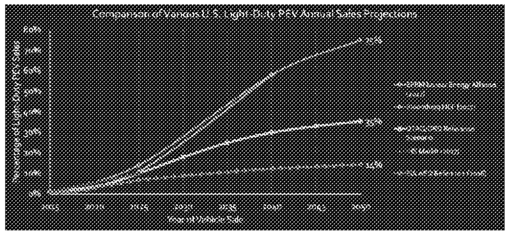
- OAP SLB listening sessions (summer 2018) found state and locals want to know how EVs can help them meet their air quality and climate goals.
- Many states are also investing in charging infrastructure through the VW Settlement or other programs
- Our results could be used to create an easy-to-use, customizable tool for planners to estimate emissions in their area for different levels of EV adoption, and different types of charging investments (e.g., workplace vs. public L2 vs DCFC)

ELECTRIC VEHICLE EMISSIONS TOMORROW

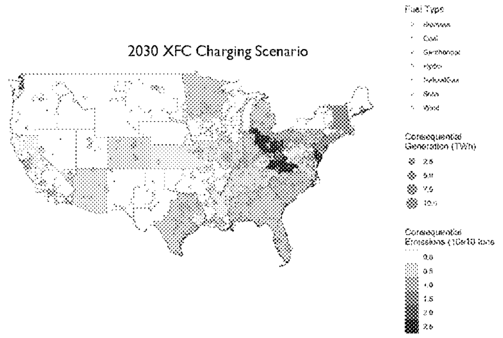


Joint OAP-ORD-OTAQ (CEMC/CASC) work

- Explore high EV adoption scenarios out to 2050
- Enhance modeling capability by linking economy-wide models used for transportation sector with electricity grid dispatch models



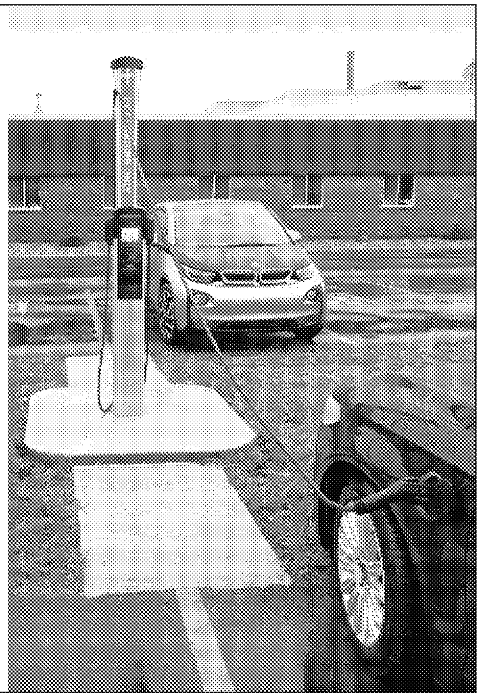
XFC STUDY: A FIRST LOOK AT THE EMISSIONS IMPACTS OF EXTREME FAST CHARGING (350 KW+)



- Conducted with RTI/UC Davis
- Bookend analysis to understand how emissions might vary if XFCs—which can recharge an EV in10–15 minutes—were the dominant charging type
- Electrify America installing this type of charging; more expected in the future

EV CHARGING INFRASTRUCTURE MODELING

- How many charging stations will be needed to meet growing EV demand?
- Where should they be located?
- How might this change in a future with a higher penetration of shared fleets?



NREL NATIONAL INFRASTRUCTURE ANALYSIS

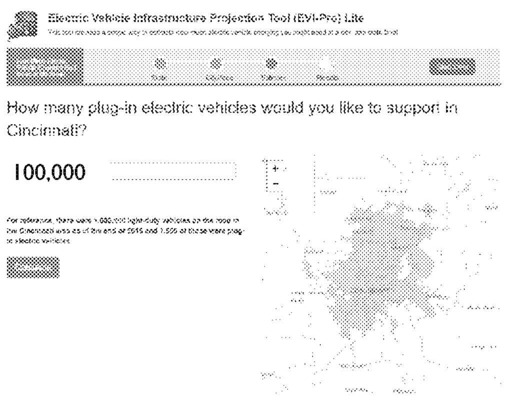
Figure ES-3. Approximate BEV driving coverage enabled by providing DCFC stations along the U.S. Interstate System. (Satellite imagery credit: © 2017 Google. Map Data © 2017 Tele Atlas)

How many charging stations will the U.S. need?

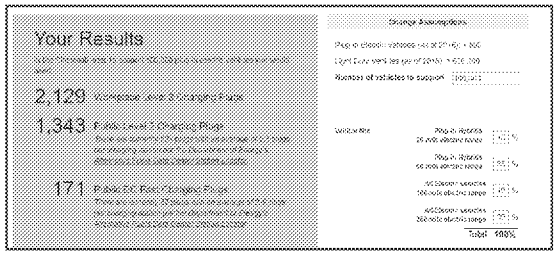
- DOE/NREL study found relatively few DC fast charging stations needed to provide a basic network of coverage
  - 400 stations for interstate corridors (70 mi spacing)
  - 8100 stations in cities and towns (3 mi spacing)
- Many more plugs needed (DC fast & Level 2) as ZEV market grows, e.g., >600K for 15M EVs/PHEVs

Current infrastructure status: >20K public stations with >65K plugs

NRELINFRASTRUCTURETOOL



- EVI-Pro Lite: estimates how much electric vehicle charging might be needed at a city and state level
- We are exploring an IAG to fund continued development of this model and tool
  - Where should stations be located?
  - How would this change for shared mobility fleets?



ZEV PROJECTS ACROSS OFFICE

- **How much does temperature impact EV range and efficiency? (TATD lead)**
  - Installing L2 charges in NVFEL testing facilities
  - Intend to measure temperature impacts (cold & hot) on variety of EVs and PHEVs
- **When do we think EVs will reach cost parity with ICEs? (ASD lead)**
  - Reviewing literature
  - Considering tear down or other analytical work
- **What is the feasibility & emissions impact of select hydrogen FCVs pathways? (ORD-CEMC lead)**
  - Examine feasibility of renewable hydrogen for MD & HD FCV applications
  - Assess lifecycle emissions impacts for different hydrogen feedstocks, storage, and delivery methods

EXTERNAL COLLABORATION

- **DOE Vehicle Technologies Office**
  - Strong coordination on EV and other future mobility topics
  - Frequently serve as reviewers for annual merit review and grants/FOAs, as well as informal reviewers and research coordination with HQ, ORNL, ANL, INL, NREL, & LBNL
- **DOE Fuel Cell Technologies Office**
  - Members of Interagency Working Group on hydrogen and fuels cells since 2012
  - Liaison for DOE-EPA coordination on Fuel Cell-related programs (e.g., DERA) and public information on advanced technology
- **UC Davis Sustainable Transportation Energy Pathways (STEPS) Program:**

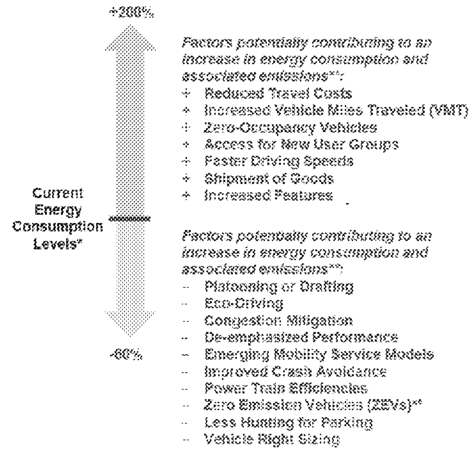
  EPA co-funds related research projects through STEPS membership including:
  - ZEV awareness and consumer education
  - Charging behavior
  - Demand drivers for infrastructure
  - 2050 ZEV adoption scenario analyses
- **California Fuel Cell Partnership (R9 lead)**

AUTONOMOUS VEHICLE PROJECTS

ENVIRONMENTAL AND ENERGY IMPACTS OF AUTOMATED VEHICLES

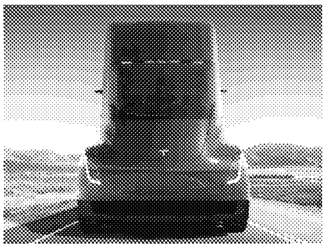
The direction and magnitude of potential environmental impacts is

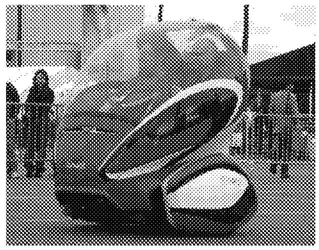
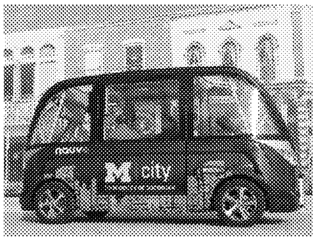
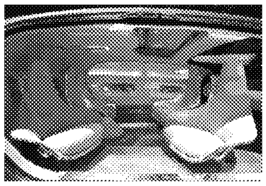
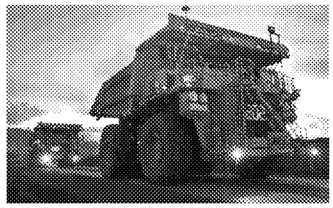
not yet understood



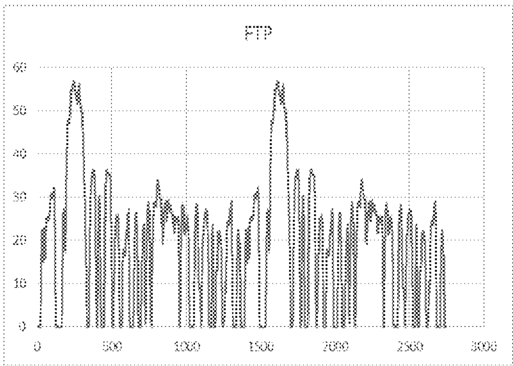
Source: The Transforming Mobility Ecosystem: Enabling an Energy-Efficient Future (DOE)

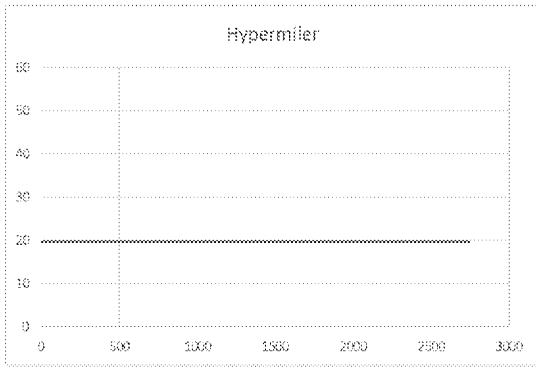
WHAT WILL THE VEHICLES LOOK LIKE?



HOW WILL THEY DRIVE?





Case 1: FTP trace
Average speed: 19.6 mph
Total distance: 14.9 miles
Total energy required: **3.12 kWh**

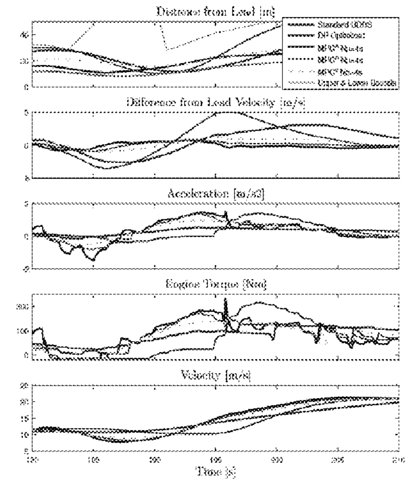
Case 2: Hypermiler
Average speed: 19.6 mph
Total distance: 14.9 miles
Total energy required: 1.03 kWh

INVESTIGATING DRIVE CYCLES USING EPA'S ALPHA MODEL

FUEL ECONOMY IMPROVEMENT

Drive Cycle	Standard Cycle MPG	Filtered Cycle MPG	Percentage Increase
FTP-72	28	30	7
US06	25	28	12
LA92	26	30	15
SC03	28	30	7
HWFET	39	41	5

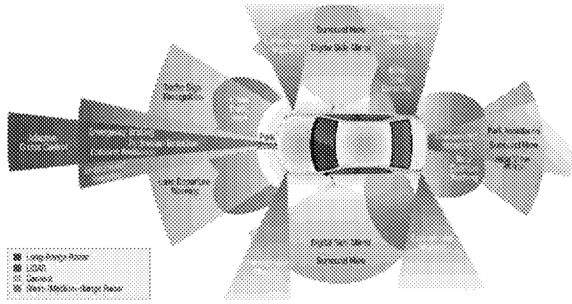
Source: Use of the hypothetical lead vehicle trace: A new driving method for evaluating fuel consumption in automated driving (Prakash, Stefanopoulou, Moskalik, Brusstar)



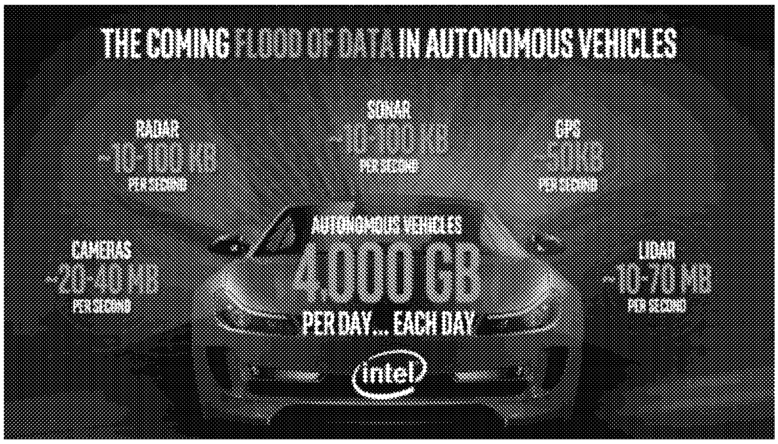
Source: Assessing fuel economy from automated driving: Influence of preview and velocity constraints (Prakash, Stefanopoulou, Brusstar)

AUTOMATED SYSTEMS REQUIRE POWER

- Automated vehicle prototypes require a LOT of power for electronics and sensors
  - ~4 kW or enough to drain about 1/3 of an EV battery pack.
- NVFEL/NCAT is benchmarking automated technologies as they become available
  - Cadillac "supercruise" did not result in increased electrical loads when enabled, implying that the sensors are online all the time.



THERE'S GOING TO BE A LOT MORE DATA



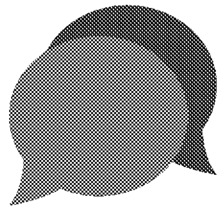
(And that's only for one hour of driving…)

EPA RESEARCH TOPICS

- **How do we certify automated vehicles? (CD lead)**
  - What if they are speed limited? Owned by the company and not for resale? Geo-fenced and can only operate in certain areas? Are we being fair to OEMs versus aftermarket companies (e.g. Waymo)?
- **What do we need to know to integrate automated vehicles into MOVES and other models? (ASD lead)**
  - How will automated vehicles operate on the road? Will this change over time, or with increasing penetration of automated vehicles?
- **How do we adequately test vehicles in our lab? (TATD lead)**
  - Are our existing tests relevant for autonomous vehicles? Can we replicate autonomous driving conditions in a lab? How do we handle vehicle power requirements if the automated system is inactive in the lab?
- **How should future regulations handle automated technologies? (TCD lead)**
  - Should automated vehicles be encouraged though policy? What if they are electrified, or used for high-occupancy shared mobility applications? What metrics should we be using and encouraging others to use? What data do we need?

ONGOING COLLABORATION MEETINGS AND ACTIVITIES

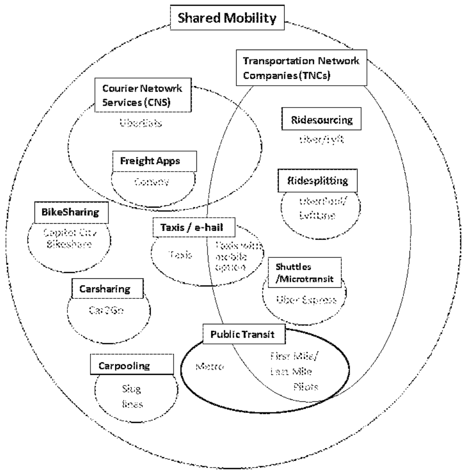
- EPA hosts a monthly meeting with DOE, DOT, national labs
  - Purpose is to present current SAEV research, discuss, and identify opportunities for collaboration
- CASC also leads a monthly OTAQ cross-divisional SAEV meeting
  - Purpose is to share information, identify challenges to OTAQ, and provide input to management on challenges and opportunities for OTAQ
- EPA has had ongoing discussions with DOE/labs for opportunity to direct national lab research agenda
  - DOE/labs are actively looking to EPA to help guide research towards relevant topics and problems
  - CASC is also involved in DOE annual merit reviews and funding reviews



SHARED MOBILITY PROJECTS

NEW SERVICE MODELS ARE PROFLIERATING

Shared Mobility= Transportation services that are shared among users



BIG QUESTIONS STARTING TO EMERGE

- What are the future emissions impacts of shared mobility?
- What are the best opportunities for minimizing emissions from shared mobility?
- How can EPA evaluate both real-world impacts and strategies for reducing emissions in this evolving field?
- How do we conduct robust analyses with limited data from transportation network companies (TNCs)?

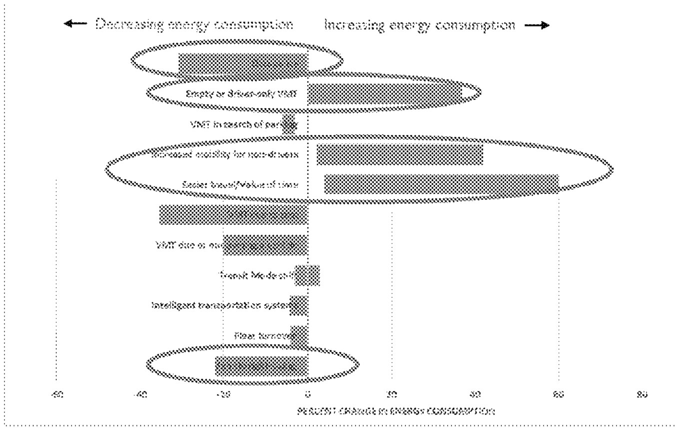
SHARED MOBILITY IMPACTS ANALYSIS

- First order "bounding exercise" conducted in early 2018 to understand the relative magnitude of different factors impacting either the VMT or fuel consumption of TNCs (not including autonomous vehicles or ZEVs)
- Combination of estimates from the literature and internal modeling

Passenger Occupancy	Empty or Driver Only VMT	VMT in search of parking	Mobility for non-drivers
Easier Travel/Value of Time	Cost	VMT change due to not owning a vehicle	Transit Mode shift
Intelligent Transportation Systems	Fleet Turnover	Vehicle Right-sizing	

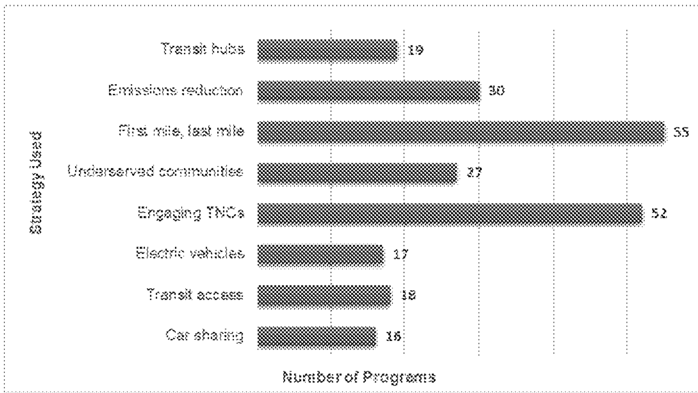
KEY TAKEAWAYS FROM SHARED IMPACTS ANALYSIS

- Energy consumption could increase by 200% or decrease by 75% for a high market penetration of TNCs
- Biggest opportunities for reducing emissions from shared services are maximizing occupancy and rightsizing as well as reducing induced demand and deadhead miles



UNDERSTANDING LOCAL "PROMISING PRACTICES" IN SHARED MOBILITY

- 2019 analysis looking at the emerging shared mobility pilots and programs in state and local areas across the US
- Heavy emphasis on programs that use TNCs to extend transit, particularly for the first/last mile
- Few programs with a specific focus on reducing emissions
- Variety of challenges and opportunities identified during research and interviews with program operators for integrating TNCs into public programs/agencies



Types of shared mobility strategies targeted by state and local areas

CASC PUBLICATIONS, TECHNICAL REVIEWS, & CONFERENCES

CASC PUBLICATIONS, TECHNICAL REVIEWS, CONFERENCES

Conference	2020 SAE Government/Industry Meeting
	• Emerging Personal Mobility Options, Session Organizer
	• Electric Vehicle Battery Session Organizer
	• Energy and Emission Impacts from AV Deployment Session Organizer
Review	2019 DOE Fuel Cell Technologies Office Merit Review, Invited Program Reviewer
Presentation	2019 Transportation Research Board Mtg, Friend or Foe: Myth-busting the competition of Fuel Cell and Electric Vehicles, Invited Speaker (presentation canceled due to shutdown)
Conference	2019 SAE Government/Industry Meeting
	• New Mobility – Emerging Personal Mobility Options Session Organizer
	• New Mobility – Potential Impacts from AV Deployment Session Organizer
Review	2019 TE3 Conference, "What does an EV replace?", Reviewer for paper submission
Review	FHWA CMAQ Cost-effectiveness tables, Reviewer 2019

CASC PUBLICATIONS, TECHNICAL REVIEWS, CONFERENCES

Review	OECD Transportation Paper, Barriers to EV adoption, 2019
Presentation	DOE ARPA-e NEXTCAR Annual Summit (2018)
Publication	The Environmental Potential of Autonomous Vehicles (Road Vehicle Automation 4, 2018)
Review	2018 DOE Fuel Cell Technologies Office Merit Review
	• Presenter, Hydrogen & Fuel Cell-Related Activities at EPA
	• Invited Program Reviewer
Review	FY18 DOE Advanced Vehicle Technologies Research Funding Opportunity Announcement on Multi-Unit Dwelling and Curbside Residential Charging Infrastructure Innovations
Review	2018 Vehicle Technologies Office Merit Review, Invited Reviewer
Conference	2018 SAE Government/Industry Meeting
	• Electric Drive Part 2 – Infrastructure Session Organizer
	• Mobility for today and tomorrow & the Role of Autonomous Vehicles

CASC PUBLICATIONS, TECHNICAL REVIEWS, CONFERENCES

Review	A Review on Energy, Environmental, and Sustainability Implications of Connected and Automated Vehicles (Env. Science and Tech., 2018)
Presentation	Transportation Research Board, Technology Changes Influencing the Decline of Vehicle Emissions, 2018 Webinar, Speaker
Review	2017 Vehicle Technologies Office Merit Review, Invited Reviewer
Conference	2017 SAE Government/Industry Meeting
	• Reconciling Competing Visions on Mobility, Part 1
Review	NREL, National Plug-In Electric Vehicle Infrastructure Analysis, 2017
Review	2017 TE3 Conference, Compatibility and Investment in the U.S. Electric Vehicle Market, Paper Review
Publication	Can Transportation Emission Reductions Be Achieved Autonomously? (Env. Science and Tech., 2015)

APPENDIX

HYDROGEN & FUEL CELL APPLICATIONS

>240MW
Backup Power

>25,000
Forklifts

>30
Fuel Cell Buses

>40
H_2 Retail Stations

>6,600
Fuel Cell Cars

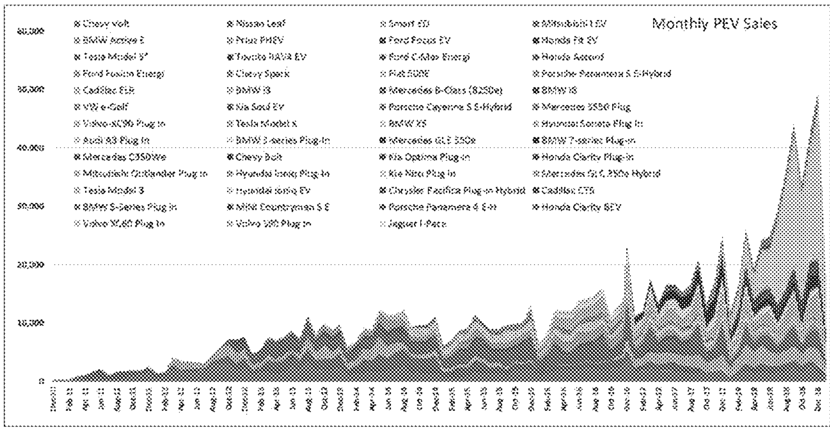
Source: DOE

Examples of Progress enabled by DOE FCTO in the last decade

Fuel Cell R&D	Reduced cost 60% Quadrupled durability	H2 Production R&D	Cut electrolyzer costs 80%

U.S. EV SALES

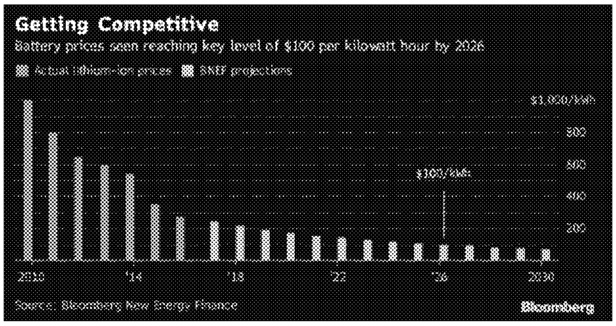
- Hit 2% of LD vehicle market in late 2018
- 40 EV & PHEV models available (as of Jan,'19)
- Highest selling models (Jan):
  - Tesla Model 3 & X
  - Chevrolet Bolt
  - Honda Clarity Plug-in
  - Toyota Prius Prime



Source: Argonne National Laboratory

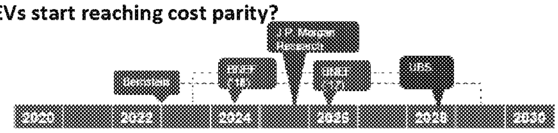
Sources:
https://www.anl.gov/es/light-duty-electric-drive-vehicles-monthly-sales-updates

Battery Costs are Decreasing



- One of the biggest market drivers has been the rapid decline of battery costs
  - Lithium-ion battery costs have already dropped ~80% relative to 2010
- Bloomberg New Energy Finance, among others, predicts upfront cost parity with gas cars in mid-2020s when battery costs reach about $100/kWh
  - Consistent with DOE battery cost targets

When do EVs start reaching cost parity?



*Projections above use different assumptions and definitions. See sources for details.

43

Source:
Graph (BNEF '17): https://about.bnef.com/blog/why-battery-cost-could-put-the-brakes-on-electric-car-sales/

Additional sources used in timeline:
BNEF '18: https://about.bnef.com/electric-vehicle-outlook/
JP Morgan Research: https://www.jpmorgan.com/global/research/electric-vehicles
UBS: https://neo.ubs.com/shared/d1wkuDlEbYPjF/
[Note: UBS defines "true cost of parity" as when OEMs achieve a 5% EBIT margin, not when upfront purchase price is the same. UBS predicts this will be reached in 2028 in the U.S. and 2023 in Europe.]
Bernstein: https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/022619-evs-to-reach-cost-parity-with-internal-combustion-cars-in-3-4-years-bernstein

AGENT BASED MODELING AND MOVES

1/10th of the cars needed, but 11% more travel

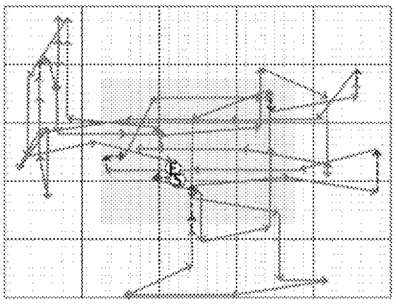


Figure 5: Travel Patterns and Operation for an Example SAV, 7 AM to Noon

The travel and environmental implications of shared autonomous vehicles, using agent-based model scenarios (Fagnant, Kockelman et al. Texas)

Small CO_2 Reductions (limited scenarios)

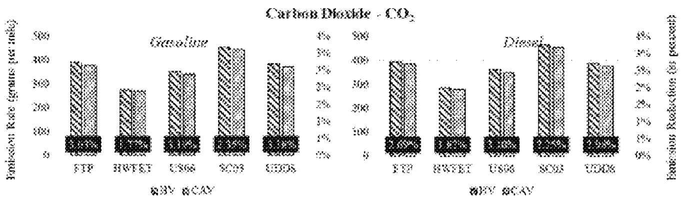


FIGURE 6 Emission Estimates for PM2.5, CO, NOx, and CO_2

Anticipating the emissions impacts of smoother driving by connected and autonomous vehicles, using the **MOVES model** (Liu, Kockelman et al. Texas)

Message

From: Burke, Susan [Burke.Susan@epa.gov]
Sent: 9/17/2019 10:32:25 PM
To: Simon, Karl [Simon.Karl@epa.gov]
CC: Snapp, Lisa [snapp.lisa@epa.gov]; Hula, Aaron [Hula.Aaron@epa.gov]; Cleveland, Meredith [Cleveland.Meredith@epa.gov]
Subject: For Review: Updated Slides for CASC SAEVs Briefing
Attachments: DRAFT OD Briefing on Analytical Work.pptx

Hi Karl,

We are currently scheduled to brief Sarah on CASC's SAEV-related work on Tuesday, October 15th. The attached slide deck incorporates your feedback from the pre-brief.

Please let us know if you have additional edits or suggestions.

Thank you,
Susan

VW Settlement – Mitigation Trust and ZEV Investment

Briefing for Sarah Dunham

October 9, 2019

Sources are listed below each slide where applicable.
[Note that some photos and graphics from external sources may be subject to copyright restrictions. Slides intended for internal use.]

- On October 25, 2016, the court approved a settlement partially resolving allegations that Volkswagen violated the Clean Air Act by the sale of vehicles containing 2.0 liter diesel engines equipped with defeat devices.
- Under this settlement, VW is required to:
  - Buyback or perform an emissions modification on at least 85% of the affected vehicles (Appendix B)
  - Invest an additional $2 billion to promote the use of zero emission vehicles and infrastructure (Appendix C)
  - $2.7 billion to fully remediate the excess NO_x emissions from the affected vehicles through a mitigation trust fund (Appendix D)
- On May 17, 2017, the court approved a second partial settlement addressing vehicles containing 3.0 liter diesel engines
  - Required buyback or perform an emissions modification on at least 85% of the affected vehicles
  - Required an additional $225 million to mitigation trust fund

A third partial settlement addressing civil penalties and injunctive relief was approved on April 13, 2017.

Sources:
https://www.epa.gov/enforcement/volkswagen-clean-air-act-civil-settlement

VW Environmental Mitigation Trust

- As part of the settlement, VW has provided ~$3 billion for 2.0 and 3.0 liter violating vehicles to an Environmental Mitigation Trust. There are two trusts- one for states and one for tribes.
- Wilmington Trust serves as trustee for both trusts.
- Funds are being used to remediate the excess NOx emissions.
- Beneficiaries must fund projects from a list of Eligible Mitigation Activities (EMAs). These projects include funding for the replacement and/or upgrade of:
  - Heavy and medium-duty trucks and buses
  - Freight switcher locomotives
  - Ferries and tugs
  - Ocean going vessel shorepower
  - Airport ground support equipment
  - Cargo handling equipment
  - Light duty charging infrastructure
  - DERA Option (use as matching funds on a DERA State or Tribal grant)

3

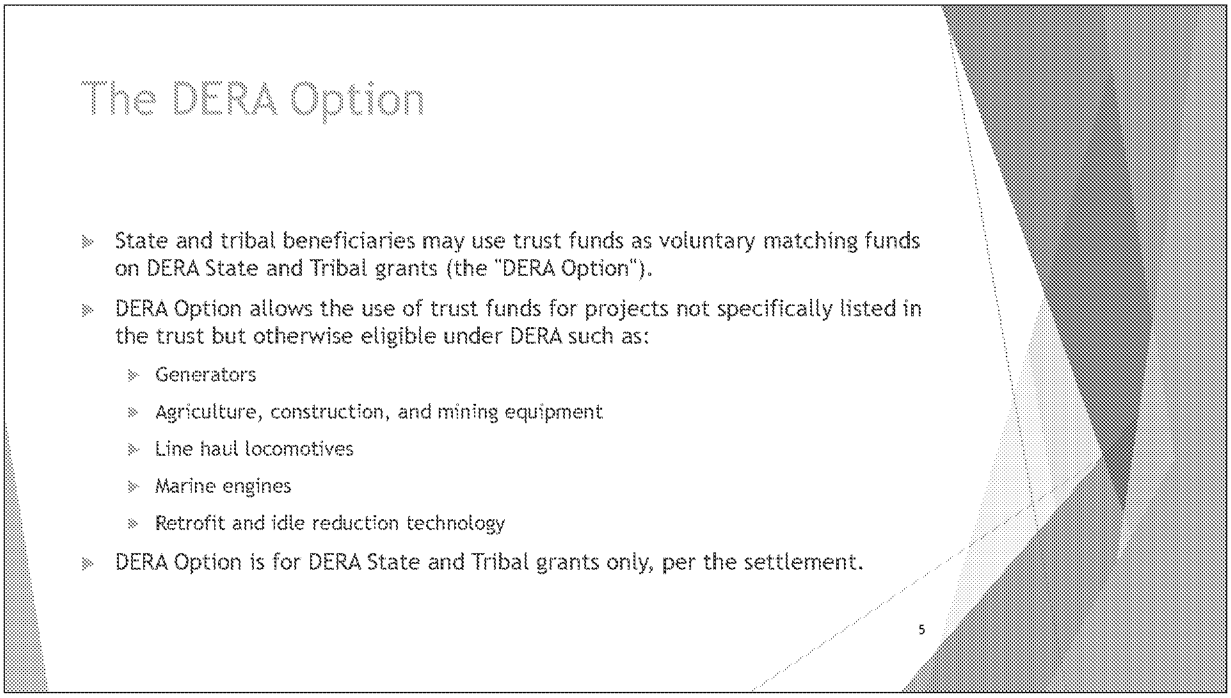
$2.7 billion for the 2.0 liter violating vehicles and $225 million for the 3.0 violating vehicles

All 50 states, DC, Puerto Rico, and federally recognized Indian tribes are eligible beneficiaries to the trust. Each state, DC, and PR receive their own allocation (ranging from $8.125M to $423M) and tribes share a $54M allocation.

VW Environmental Mitigation Trust

- Trust Effective Date -- October 2, 2017
- All states, the District of Columbia, and Puerto Rico certified as beneficiaries. Each state has a specific allocation.
  - Allocations range from $8.125 million to $423 million
- State beneficiaries must submit beneficiary mitigation plans before accessing trust funds. There is no specific due date for state beneficiary mitigation plans.
  - Tribal beneficiaries do not submit beneficiary mitigation plans.
- Tribes share an allocation of ~$54 million.
  - Tribes certify as beneficiaries to participate at the start of a funding cycle.
  - There will be four funding cycles with a possible fifth if funds go unclaimed.
  - Currently in the second funding cycle.
  - Nearly 70 tribes have certified as beneficiaries so far.

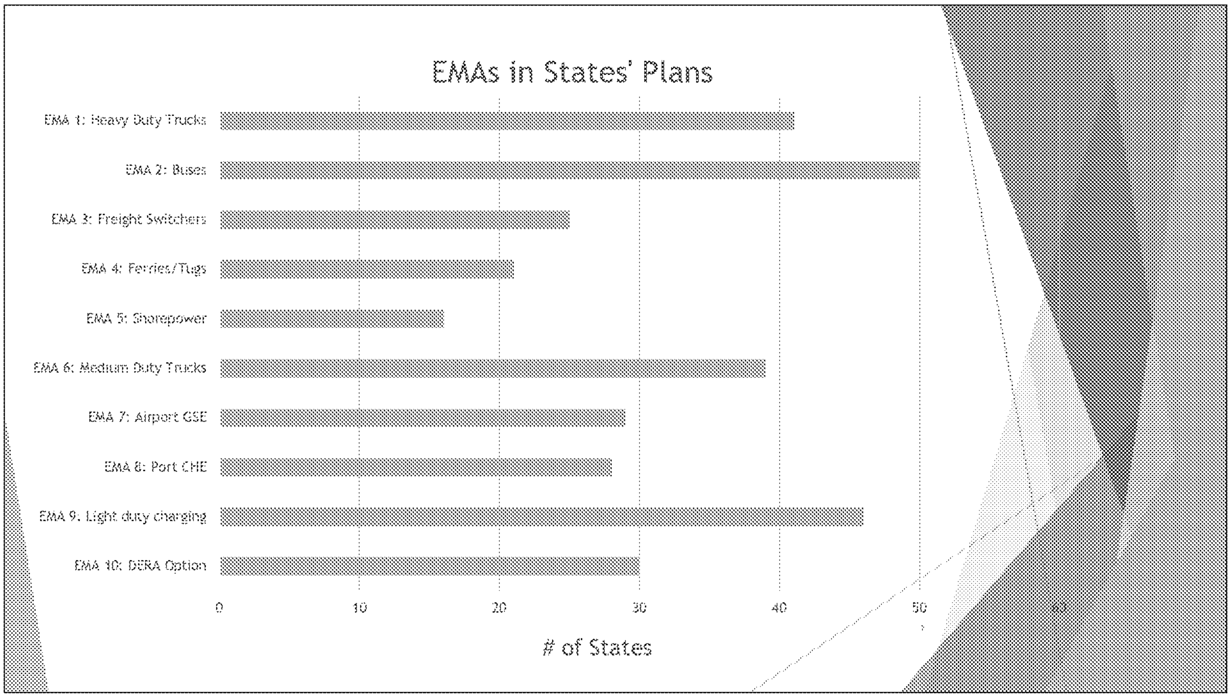
The smallest allocation for any state is $8.125m (includes PR, ND, HI, SD, AK, WY, DC)



6 tribes have used the DERA Option in the last two DERA RFAs. 35 states have indicated they will use the DERA Option for their FY19 DERA State grants.

Status of States' Beneficiary Mitigation Plans

- States must post plans to their websites so they are publicly accessible.
- Most states have final plans, but a few are still in draft form.
- Plans are not binding and may be edited in the future. A few states only have plans for the first few funding years and will reassess in the future.



Some states listed "nonroad" as a priority and listed all possible nonroad EMAs without specifying which they would fund. Therefore, some EMAs may be artificially high (such as EMA 5: ocean going vessel shorepower).
31 states plan to "max out" EMA 9 with 15% of their funding.
This chart is not final. States may change priorities and add/drop EMAs.

California ($423 million)

EMA	Benefiting Disadvantaged or Low-income Communities	Project allocation (millions)
Zero-emission transit, school, shuttle buses	50%	$130
Zero-emission Class 8 freight and port dray trucks	50%	$90
Zero-emission freight and marine projects	75%	$70
Combustion freight and marine projects	50%	$60
Light-duty zero-emission vehicle infrastructure	35%	$10
Reserve (including admin)		$63
Total	**>50%**	**$423**

Projects in disadvantaged communities are not required in the trust agreement. However, their beneficiary mitigation plans need to address "how the beneficiary will consider the potential beneficial impact of the selected EMAs on air quality in areas that bear a disproportionate share of the air pollution within its jurisdiction." Beneficiaries are also instructed in their funding requests to include: "If applicable, a description of how the EMA mitigates the impact of NOx emissions on communities that have historically borne a disproportionate share o adverse impacts of such emissions."

ZEV freight and marine: forklifts and port CHE, airport GSE, OGV shorepower, ferry/tugboat/towboat repowers

Combustion freight and marine: Lox NOx Class 7-8 freight trucks, Tier 4 switchers, Tier 4 or hybrid ferry/tugboat/towboat repowers

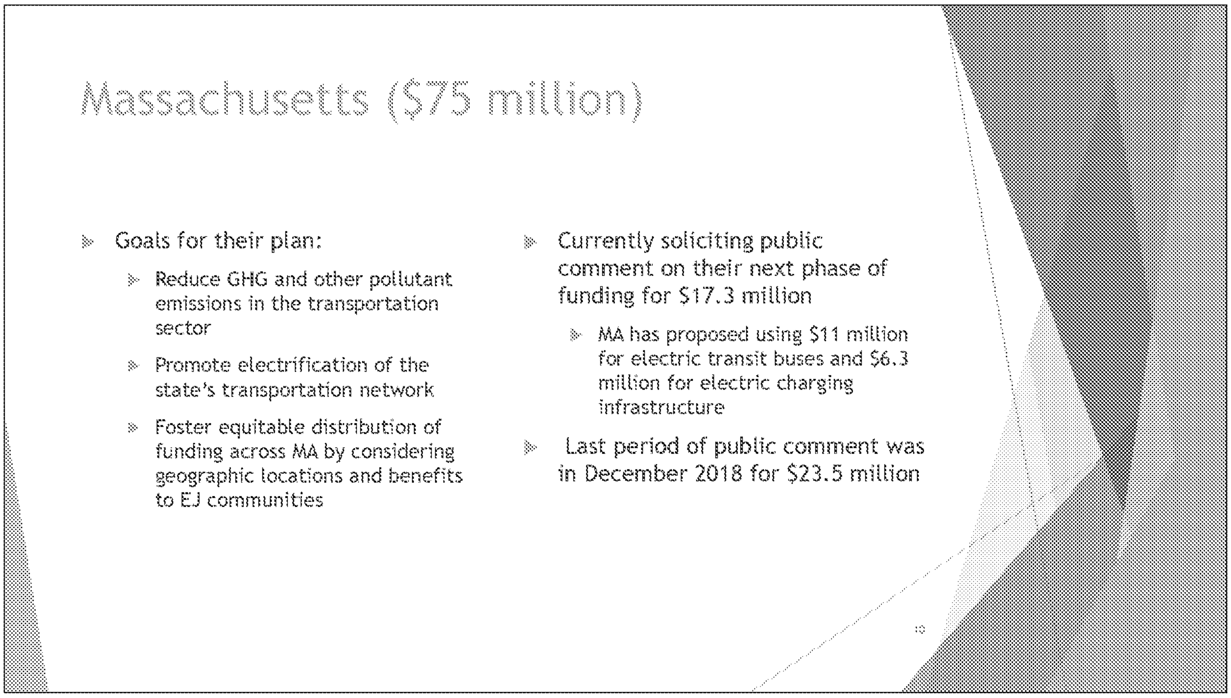
Rhode Island ($14 million)

- RIPTA bus replacement project ~$10 million
  - Replace 20 diesel class 4-8 transit buses with new all-electric vehicles.
- Light duty zero-emission vehicle supply equipment project ~$1.5 million
  - Enhance public charging infrastructure particularly along I-95
  - Focus areas will be transit hubs such as the airport, train stations, publicly-owned lots at popular destinations, workplaces
- Admin ~$2.15 million

Photo: ZEV bus funded with VW settlement funds.

RIPTA bus replacement will start with three buses, they'll do an evaluation period, and then purchase up to 20 ZEV buses total.

EMA 9 will include level 1, 2, DC fast chargers. Funds will be administered using a competitive process



Some states did not make allocation decisions for all their funding straight away, instead choosing to make decisions in phases. MA is currently seeking input on their next phase for $17.3m of their $75m allocation.

The additional funding will bring total spending to approximately $40.8m and includes $22m for electric transit buses; $11.3m for charging infrastructure; $7.5m for other EMA projects

States that have requested funding so far:

Arizona	Nebraska
California	Nevada
Colorado	New Jersey
Georgia	Ohio
Idaho	Oklahoma
Illinois	Oregon
Iowa	Rhode Island
Louisiana	South Dakota
Maine	Texas
Minnesota	Virginia
Missouri	

- Projects include: bus and truck replacements, charging infrastructure, DERA Option, airport GSE
- States must fulfill biannual reporting requirements that are posted on the trustee's website

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Six months after receiving funds and then every January and July, states must report:
Summary of all costs expended on EMAs
Description of the status (including actual or projected termination date)
Development, implementation, and modification of each approved EMA.

Zero Emission Vehicle (ZEV) Investment

- Volkswagen required to invest $2 billion over 10 years in four 30-month cycles
  - $1.2 billion National ZEV Investment (excludes CA)
  - $800 million California ZEV Investment

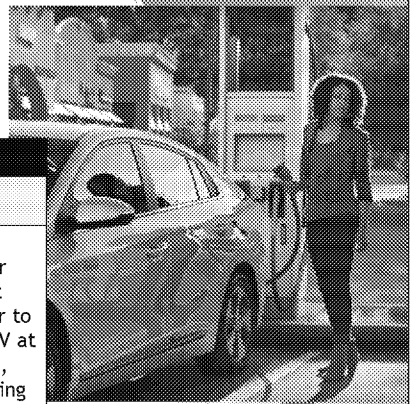
- Electrify America (EA), a wholly-owned subsidiary of Volkswagen Group of America, was established to fulfill the ZEV Investment requirements of the settlement

- EA must submit ZEV Investment Plans to the EPA and California Air Resources Board for their approval for each cycle, and must provide annual reports on progress
  - All investment decisions rest with the Settling Defendants
  - EPA's role is limited to verifying that investments are consistent with the terms of the consent decree
  - OECA reviews and approves National ZEV Investment Plans (with OTAQ support)

Zero Emission Vehicle Investment

Allowable investments under the Consent Decree:

Infrastructure	Education	Access
• Level 2 charging at multi-unit dwellings, workplaces, and public sites • DC fast charging facilities • Later generations of charging infrastructure • Hydrogen fueling stations	• To build or increase public awareness of ZEVs • Brand-neutral media activities such as print, television, radio, websites, and social media • $25-50 million investment required each cycle	• Programs to increase public exposure and/or access to ZEVs without requiring the consumer to purchase or lease a ZEV at full market value, e.g., car share and ride hailing services, ride and drive events



Source: Electrify America

Additional investment types allowed under California ZEV Investment

Sources:
Screenshot: https://www.plugintothepresent.com/#tv-spot

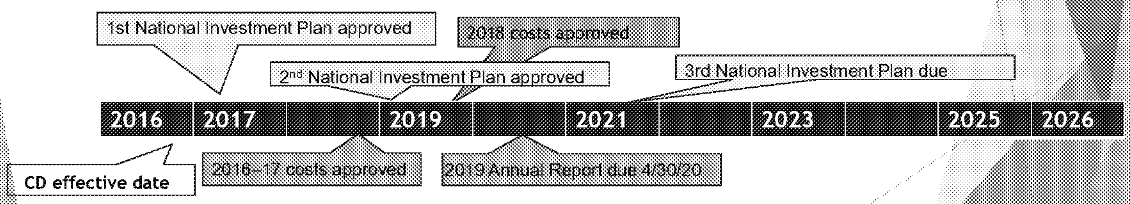
Process & Timeline

National ZEV Investment Plans—Every 2.5 years

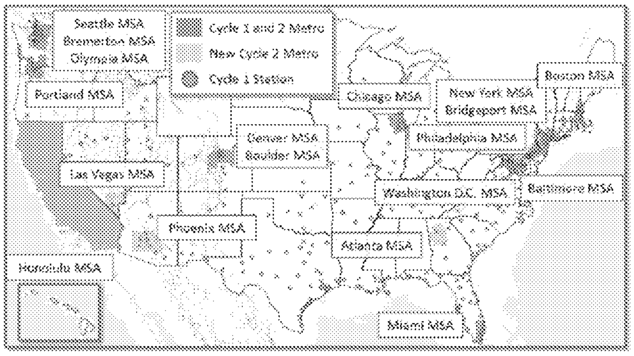
- EA provides opportunity for states, municipal governments, tribes, and federal agencies to provide input
- EA submits draft National plan to EPA
- EPA reviews plan, and "meets and confers" with EA as soon as possible after submittal
- EA submits final plan to EPA for approval

Annual Reports & Creditable Costs—Every year

- EA submits report to EPA by April 30th describing the status of the National ZEV Investment and costs for previous year
- Independent third-party accounting firm audits and reviews costs EA claims are creditable
- OECA approves or disapproves creditable costs (with OTAQ support)



National ZEV Investment—Infrastructure



Additional cycle 1 metro areas: Houston & Raleigh; CA metro areas not shown.

Cycle 1 (Jan 2017 to Jun 2019)

- 450-540 charging stations
  - **Nationwide DCFC highway network**
  - Community charging in 11 metro areas (L2 & DCFC stations)

Cycle 2 (July 2019 to Dec 2021)

- About 215 charging stations (DCFC)
  - Additional stations for Cycle 1 nationwide highway network
  - Four regional highway routes
  - **Community charging in 18 metro areas**

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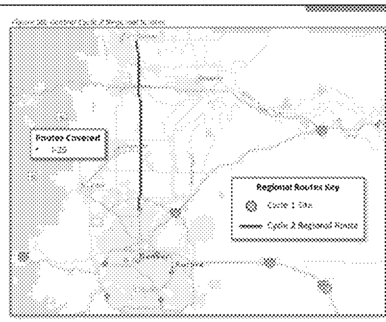
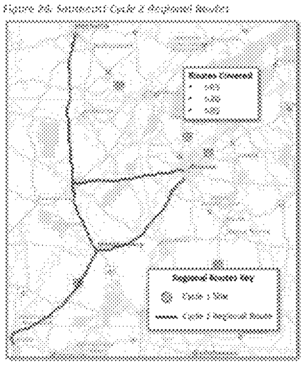
Sources:
Graphic from Electrify America: https://www.epa.gov/enforcement/epa-approved-national-zev-investment-plan-cycle-2-public-version
Cycle 1 Infrastructure Spend: $250 M
Nationwide Highway Network: $190 M
Metro Community Charging: $40 M
Plus $20 M operation costs
Cycle 2 Infrastructure Spend: $235M + $10 M branded marketing
Metro Community Charging: $145M – $165 M
Highways and Regional Routes: $65 – $85 M
Autonomous Vehicle Charging: $2 – $4 M

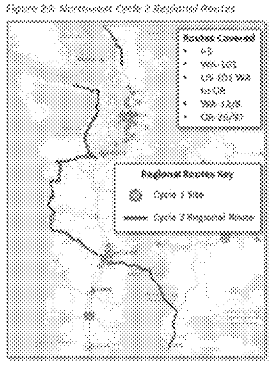
Nationwide Highway Network:
Cycle 1: 150–240 stations (avg spacing 66 mi apart)
Cycle 2: Up to 28 additional stations

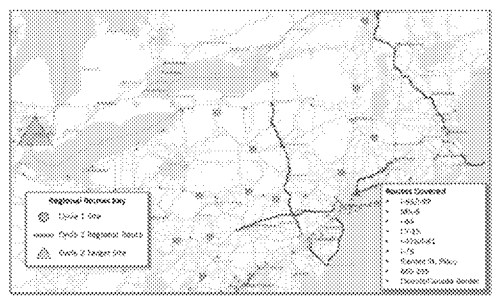
Regional Highway Corridors

- Cycle 2 plan includes establishing regional corridors in four parts of the country: Central, Southeast, Northwest and Northeast









Sources:
Graphic from Electrify America: https://www.epa.gov/enforcement/epa-approved-national-zev-investment-plan-cycle-2-public-version
Cycle 2 Regional Routes: 33 – 35 stations total

Metro Area Charging

- **Station Locations**
  - Multi-unit dwellings
  - Retail locations
  - Community depots & municipal garages
  - Workplaces (cycle 1)
- **New for Cycle 2**
  - Shared mobility fleet charging
  - Autonomous vehicle charging (small pilot: Up to 2 stations)

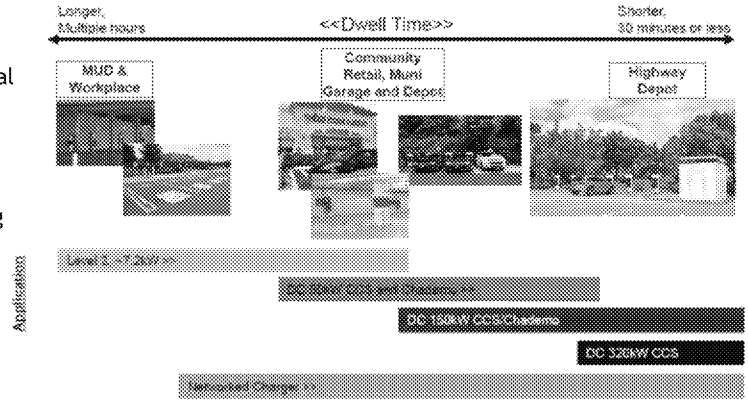
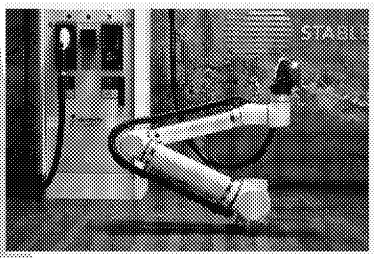
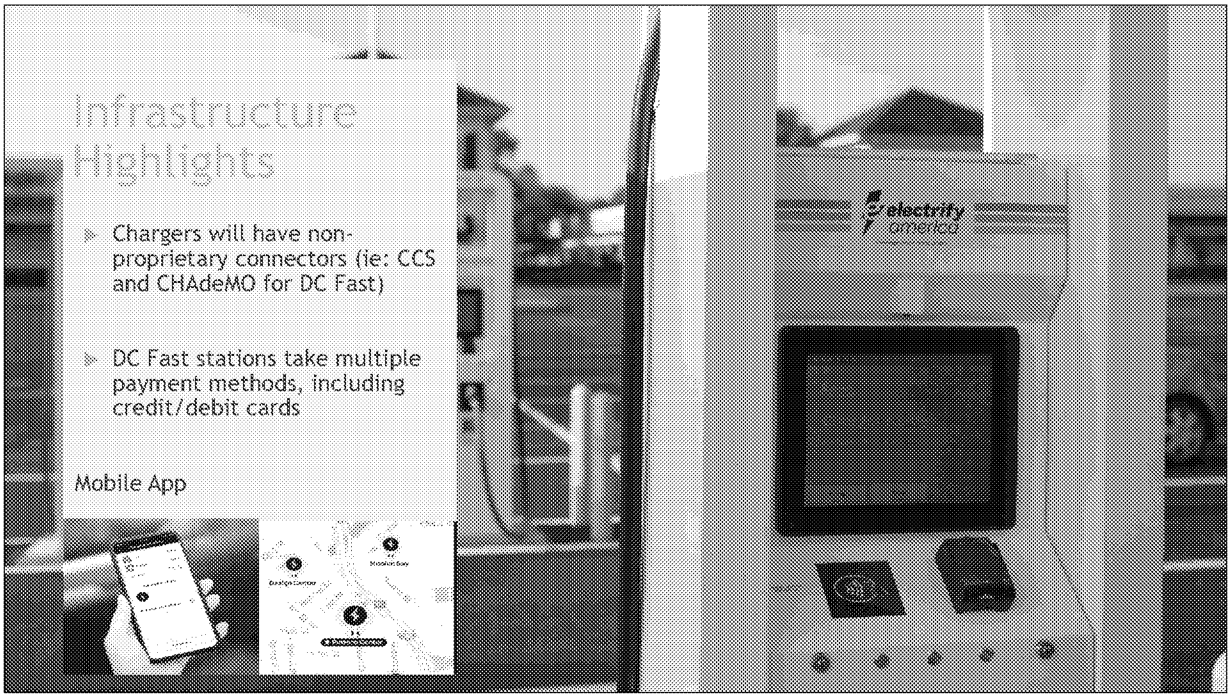


FIGURE 6: OVERVIEW OF MAJOR USE CASES TO BE PRIORITIZED IN FIRST CYCLE



17

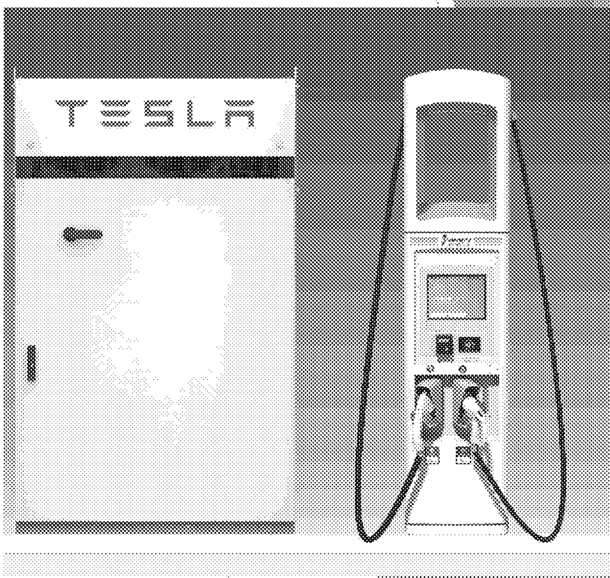
Cycle 1 metro: 300+ stations
Cycle 2 metro stations: 136 – 169 metro stations (not including autonomous)
105 – 125 retail/community
8 – 12 MUD
15 – 20 shared
8 – 12 upgrades to highly utilized locations
Bottom right photo: San Francisco-based electric vehicle (EV) fleet charging company Stable Auto & EA to deploy pilot demonstration of robotic charging in San Francisco



Source: Electrify America
EA also supporting open protocols that allow for communication between different chargers and networks

Infrastructure Partnerships

- Electrify America fast charging stations at >120 Walmart locations
- Partnering with Target, Sheetz, Casey's General Stores, Simon Property Group and 20 other large-scale real estate owners to site stations
- Interoperability agreements with charging providers EVgo, ChargePoint, Greenlots, Sema Connect, & EV Connect to increase station access
- Electrify America deploying Tesla Battery Storage systems at >100 stations to manage peak demand

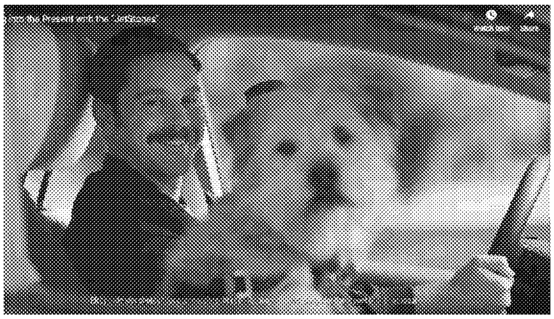


19

Walmart stations in 34 states

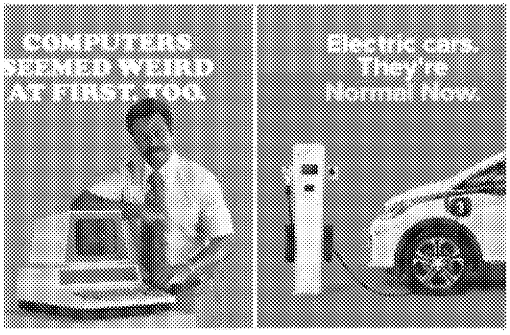
Education Campaigns

Cycle 1: The JetStones/Plug in to the Present



- Traditional media: TV spots, out-of-home (billboards)
- Digital: social media, website, digital radio, search

Cycle 2: Normal Now



- Shifting focus from traditional to digital media as cycle progresses
- New: social media influencers, STEM curriculum development, experience centers
- Ride & Drives ($0.5M access investment)

Next Steps

- Meeting with Electrify America President & CEO Giovanni Palazzo on Oct 29th
- Next Annual Report—covering 2019 investments and creditable costs—due April 30th

Appendix

Cycle 2 National Outreach Summary

- For the Cycle 2 ZEV Investment plans, EA considered 780 comments from 47 states + DC

Figure 5: Submissions by State

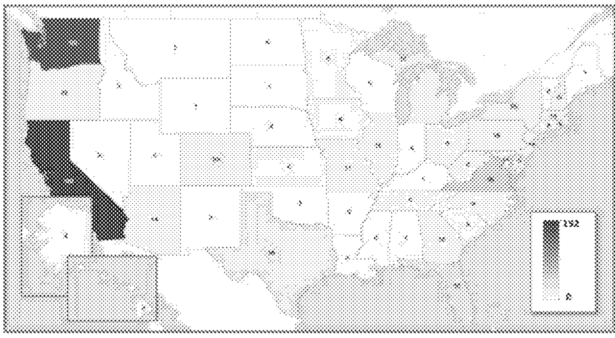
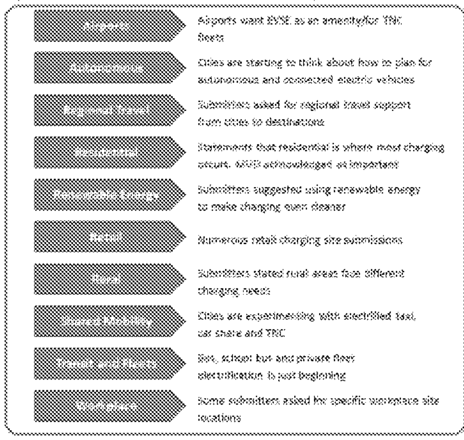


Figure 6: Themes from National Outreach Responses

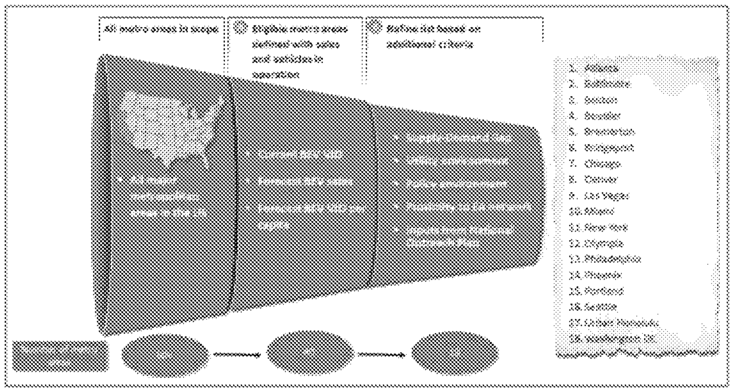


- EA has opted to accept submissions/input for future ZEV Investment plans year-round on its website

Metro Area Selection Process (Cycle 2)

1. Started with most populous metro markets and assessed BEV sales for today and forecasted sales for 2022
2. Advanced metro areas that submitted progressive suggestions during National Outreach to next phase of selection process
3. Evaluated expected charging needs through supply-demand gap analysis, looked at local utility costs and collaboration environment, state and local policies impacting EV adoption, and fit within EA's existing network.

Figure 20: Cycle 2 Metro Selection Process



NREL Infrastructure Assessment

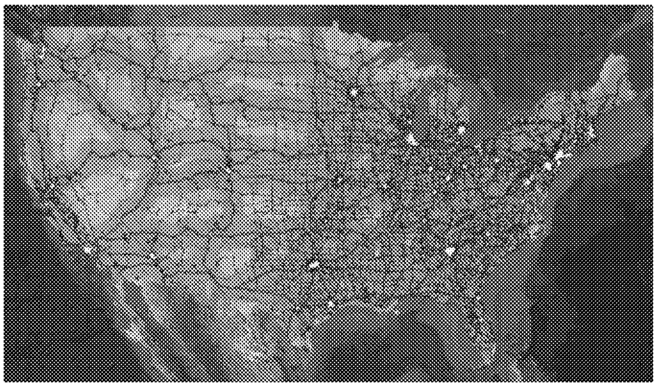


Figure ES-3. Approximate BEV driving coverage enabled by providing DCFC stations along the U.S. Interstate System. (Satellite imagery credit: © 2017 Google, Map Data © 2017 Tele Atlas)

Source: National Renewable Energy Laboratory

- NREL study found only about 400 fast charging stations needed to provide basic coverage on U.S. Interstate System
  - 70 mi spacing between stations
- Between cycles 1 & 2, EA plans to build 300+ stations for nationwide highway network (includes CA)
  - Avg station spacing 66 mi in much of U.S.

Source:
https://energy.gov/sites/prod/files/2017/09/f36/NationalPlugInElectricVehicleInfrastructureAnalysis_Sept2017.pdf

Message

From: Kenausis, Kristin [Kenausis.Kristin@epa.gov]
Sent: 11/5/2019 8:18:35 PM
To: Simon, Karl [Simon.Karl@epa.gov]
CC: Snapp, Lisa [snapp.lisa@epa.gov]; Graff, Michelle [graff.michelle@epa.gov]
Subject: The long-awaited "EV Myths" document (very short!), for your review
Attachments: Draft EV Myths 110419.docx

Hi Karl,

We completed phase 1 of the EV myths document. Lisa, Susan, and Erin have reviewed it. Of note:

- The formatting will resemble our Greenhouse Gas Emissions from a Typical Passenger Vehicle page. This accordion style has the potential to make each a “stand alone” statement, so we spelled out “electric vehicles” in the beginning of each myth. (It looks a bit duplicative in the Word doc.)
- This is just phase 1. We hope to add more myths to list in the near future. Topics may include “EVs are expensive and hard to maintain” plus we hope to add more details on how cold weather affects range.
- More EV content coming! We are starting to develop a web page devoted to EV charging, which will include charger options, how to charge, where to find chargers, etc.

Please send us any feedback you may have on the myths document. Next stop, once we incorporate your feedback, is OAR comms.

Kristin Kenausis
U.S. Environmental Protection Agency
Office of Transportation and Air Quality
(202) 343-9225
e-mail: kenausis.kristin@epa.gov

Message

From: Snapp, Lisa [snapp.lisa@epa.gov]
Sent: 1/9/2020 10:27:38 PM
To: Simon, Karl [Simon.Karl@epa.gov]
CC: Kenausis, Kristin [Kenausis.Kristin@epa.gov]; Graff, Michelle [graff.michelle@epa.gov]
Subject: EV Myths
Attachments: Draft EV Myths 010920 v2.docx

Hi Karl—

Here is the updated version of the EV Myths document, which we hope to post on the Green Vehicle Guide. It incorporates your comments as well as those by Susan. Please let us know if it needs additional edits before it goes to Erin. I expect she will run it by Sarah.

Thanks to Kristin and Michelle for crafting and running the traps.

Thanks--Lisa

Message

From: Lie, Sharyn [Lie.Sharyn@epa.gov]
Sent: 1/27/2020 10:18:51 PM
To: Hengst, Benjamin [Hengst.Benjamin@epa.gov]
CC: Simon, Karl [Simon.Karl@epa.gov]
Subject: Block 5 Slides for fuels retreat
Attachments: 2020.01 Block 5 Electricity and Other Fuels.pptx

Hi Ben-

Attached are slides for Block 5.

Cheers,
Sharyn

-----Original Message-----
From: Hengst, Benjamin <Hengst.Benjamin@epa.gov>
Sent: Friday, January 24, 2020 5:13 PM
To: Lie, Sharyn <Lie.Sharyn@epa.gov>
Subject:

Hi Sharyn.

Are you still planning on doing slides for the Wednesday block on electrification? I'll need to see them just to make sure me/you/facilitators are on same page. Maybe Monday?

Message

From: Charmley, William [charmley.william@epa.gov]
Sent: 1/27/2020 5:00:14 PM
To: Moran, Robin [moran.robin@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Sherwood, Todd [sherwood.todd@epa.gov]; Lieske, Christopher [lieske.christopher@epa.gov]; Barba, Daniel [Barba.Daniel@epa.gov]; Moskalik, Andrew [Moskalik.Andrew@epa.gov]
CC: Orlin, David [Orlin.David@epa.gov]; Buchsbaum, Seth [buchsbaum.seth@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]
Subject: Background information on EPA models, tools, and data that we shared with AA Wehrum and others related to the SAFE rule assessment
Attachments: MTE Data and Modeling Briefing_AA_Wehrum_11202017_Final.pptx; MTE_OMEGA results Wehrum_20180109_Final Version.pptx; Status of SAFE rulemakingforAnneldsal_7_11_2019 final Rev A.pptx; Briefing for B. Wehrum on ALPHA 12_1_2017.pptx; MTE Briefing for AA Wehrum_Nov 17_2017_Final.pptx

Dear all –

Ex. 5 Deliberative Process (DP)

Thanks
Bill

<< parts of Charmley's 1/24/2020 email to Sarah Dunham >>

Ex. 5 Deliberative Process (DP)

Message

From: Birgfeld, Erin [Birgfeld.Erin@epa.gov]
Sent: 2/3/2020 9:36:53 PM
To: Dunham, Sarah [Dunham.Sarah@epa.gov]
CC: Simon, Karl [Simon.Karl@epa.gov]
Subject: New Web Content on EV Myths
Attachments: Draft EV Myths 020320.docx

Dear Sarah,

The CASC team has developed a new webpage for the Green Vehicle Guide that would focus Myths related to Electric Vehicles.
The content is attached for your review. Let me know if you have any edits.

Thanks,
Erin

Message

From: Charmley, William [charmley.william@epa.gov]
Sent: 3/27/2020 2:51:41 PM
To: Simon, Karl [Simon.Karl@epa.gov]
Subject: FW: Materials for CTI Briefing Tomorrow (3/25) at 1pm
Attachments: 2020-03-23_CTI_Incentives_OD_Dunham.pptx

I just realized you are not on this email or on the calendar invite for our 11 am with Sarah today, and I think you will be interested in this topic. I apologize for that – it has been one of those weeks.

From: Parsons, Christy <Parsons.Christy@epa.gov>
Sent: Tuesday, March 24, 2020 3:49 PM
To: OTAQ Materials <OTAQMaterials@epa.gov>
Cc: Charmley, William <charmley.william@epa.gov>; Sargeant, Kathryn <sargeant.kathryn@epa.gov>; Nelson, Brian <nelson.brian@epa.gov>; Sanchez, James <sanchez.james@epa.gov>; Brakora, Jessica <Brakora.Jessica@epa.gov>; Kataoka, Mark <Kataoka.Mark@epa.gov>; Carrillo, Andrea <Carrillo.Andrea@epa.gov>
Subject: Materials for CTI Briefing Tomorrow (3/25) at 1pm

Attached are materials for our meeting with Sarah tomorrow at 1pm, "CTI NPRM: Options for Emission Credit Multipliers".

Please let us know if any additional information would be useful ahead of time.

Thank you,
Christy

Christy Parsons
Physical Scientist
Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
Ann Arbor, MI

Tel: 734.214.4243
E-mail: parsons.christy@epa.gov

Message

From: Parsons, Christy [Parsons.Christy@epa.gov]
Sent: 4/3/2020 12:35:22 PM
To: OAR Briefings [OAR_Briefings@epa.gov]
CC: OTAQ Materials [OTAQMaterials@epa.gov]; Charmley, William [charmley.william@epa.gov]; Sargeant, Kathryn [sargeant.kathryn@epa.gov]; Nelson, Brian [nelson.brian@epa.gov]; Brakora, Jessica [Brakora.Jessica@epa.gov]; Sanchez, James [sanchez.james@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]; Carrillo, Andrea [Carrillo.Andrea@epa.gov]; Orlin, David [Orlin.David@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]
Subject: Materials for 1pm today "CTI Update + Regulatory Incentives Discussion" with AA Idsal
Attachments: 2020-04-03_CTI_Incentives_AA-Idsal.pptx

Attached are materials for the "CTI Update + Regulatory Incentives Discussion" with AA Idsal today at 1pm.

Please let us know if any additional information would be useful ahead of time.

Thank you,
Christy

Christy Parsons
Physical Scientist
Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
Ann Arbor, MI

Tel: 734.214.4243
E-mail: parsons.christy@epa.gov

Message

From: Safoutin, Mike [safoutin.mike@epa.gov]
Sent: 5/27/2020 12:29:59 PM
To: Simon, Karl [Simon.Karl@epa.gov]
Subject: RE: Status Update on EV Cost Parity
Attachments: Cost parity_DRAFT_v5.docx; EV Price parity Is it Panic Time Yet - V2 Jan 2020.docx

Hi Karl,

Here are the two white papers, which are a bit cleaner to read than the combined version. The first is my four-pager for ASD and the other is Andy's literature review, which he did for TATD. Thanks,

Mike

From: Simon, Karl <Simon.Karl@epa.gov>
Sent: Wednesday, May 27, 2020 8:22 AM
To: Safoutin, Mike <safoutin.mike@epa.gov>
Subject: RE: Status Update on EV Cost Parity

Mike,

Send me the white paper you mention on slide 22. thanks

From: Safoutin, Mike <safoutin.mike@epa.gov>
Sent: Tuesday, May 26, 2020 11:21 PM
To: Charmley, William <charmley.william@epa.gov>; Olechiw, Michael <olechiw.michael@epa.gov>; Moran, Robin <moran.robin@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>; Snapp, Lisa <snapp.lisa@epa.gov>; Moskalik, Andrew <Moskalik.Andrew@epa.gov>; Jackman, Dana <jackman.dana@epa.gov>; Helfand, Gloria <helfand.gloria@epa.gov>; Bolon, Kevin <Bolon.Kevin@epa.gov>; Barba, Daniel <Barba.Daniel@epa.gov>; Haugen, David <haugen.david@epa.gov>
Subject: RE: Status Update on EV Cost Parity

Draft powerpoint slides attached.

-----Original Appointment-----
From: Charmley, William <charmley.william@epa.gov>
Sent: Thursday, May 7, 2020 10:00 AM
To: Charmley, William; Olechiw, Michael; Moran, Robin; Simon, Karl; Snapp, Lisa; Safoutin, Mike; Moskalik, Andrew; Jackman, Dana; Helfand, Gloria; Bolon, Kevin; Barba, Daniel; Haugen, David
Subject: Status Update on EV Cost Parity
When: Wednesday, May 27, 2020 11:05 AM-12:00 PM (UTC-05:00) Eastern Time (US & Canada).
Where: Microsoft Teams Meeting

Join Microsoft Teams Meeting

Ex. 6 Personal Privacy (PP) tes, Washington DC (Toll)

Local numbers | Reset PIN | Learn more about Teams | Meeting options

Message

From: Charmley, William [charmley.william@epa.gov]
Sent: 6/12/2020 12:23:05 PM
To: Dunham, Sarah [Dunham.Sarah@epa.gov]
CC: Simon, Karl [Simon.Karl@epa.gov]; Haugen, David [haugen.david@epa.gov]; Hengst, Benjamin [Hengst.Benjamin@epa.gov]; Cook, Leila [cook.leila@epa.gov]
Subject: Today's 1pm meeting with Sarah regarding "NAS Fuel Economy Study Meeting with EPA"
Attachments: EV technology NAS Presentation June 2020, for Sarah.pptx; 2020 NAS presentation of NCAT work v8 for Sarah.pptx; 20200616 NAS Phase 3 OMEGA overview_draft, for Sarah.pptx

Dear Sarah,

I wanted to provide some background information for you for the meeting with the staff this afternoon regarding next week's OTAQ technical meeting with the National Academy of Science Committee on Light-duty Vehicle Fuel Economy. Robin sent you the briefing material for you yesterday. It is similar to the material we reviewed with Anne Idsal on Monday, but with a little more detail.

We have invited all of the staff who are presenting to participate in the 45 minute meeting with you. Karl, David and I have met with the staff and managers a few times regarding the meeting next week. In addition, the 3 of us are ensuring that each presentation is being reviewed by at least one Division Director, in addition to the review which Robin Moran, Mike Olechiw and others have done. Ex. 5 Attorney Client (AC)

Ex. 5 Attorney Client (AC)

The technical staff across TCD, TATD, and ASD have put a significant amount of time in preparing for this meeting. There is a lot of enthusiasm among the staff, as they are proud to be able to present and talk about the range of technical projects they have been and are working on. The presentation material is still being fine-tuned, with some nearly done and others needing a little more work. To give you a sense of the information, I have attached 3 of the presentations which are nearly done as examples. I highlighted in blue the presentations I have attached. I am not asking you to review these – I am providing them so you have a feel for the level of detail and type of information we are presenting, so please don't feel obligated to review these.

However, if you do want to review/see specific presentations, or all of them, please just let us know and we will make that happen.

Thanks
Bill

<u>Agenda for meeting with EPA presenters highlighted</u>

- 12:00 PM Introduction, Beth Zeitler, NASEM Study Director
- 12:05 PM Opening EPA Remarks, Bill Charmley, Director, Assessment and Standards Division

- 12:15 PM Powertrain Benchmark Testing, Dan Barba, Director, National Center of Advanced Technology, Andrew Moskalik, Ph.D. engineer
- 1:15 PM Electric Vehicle Technology Issues, Mike Safoutin, Ph.D. engineer
- 1:45 PM Electric Vehicle International Issues, Mike Olechiw, Director, Light-duty Vehicle and Small Engines Center
- 2:00 PM 15-minute break
- 2:15 PM Economic and Consumer Issues, Gloria Helfand, PhD economist, Christian Noyce, ORISE fellow, Asa Watten, ORISE fellow, Dana Jackman, PhD economist
- 3:15 PM ALPHA & OMEGA Models Continued Development, Kevin Newman, Meng, Kevin Bolon, PhD engineer
- 4:00 PM Emerging Trends in Transportation, Karl Simon, Director, Transportation and Climate Division
- 4:30 PM Committee questions
- 5:00 PM ADJOURN

From: Moran, Robin <moran.robin@epa.gov>
Sent: Thursday, June 11, 2020 3:46 PM
To: OTAQ Materials <OTAQMaterials@epa.gov>
Cc: Charmley, William <charmley.william@epa.gov>; Simon, Karl <Simon.Karl@epa.gov>; Haugen, David <haugen.david@epa.gov>; Olechiw, Michael <olechiw.michael@epa.gov>; Orlin, David <Orlin.David@epa.gov>; Kataoka, Mark <Kataoka.Mark@epa.gov>
Subject: Materials for tomorrow (Friday) 1pm w/Sarah: "NAS Fuel Economy Study Meeting with EPA"

Sarah,

Attached is the material for our discussion with you tomorrow on the NAS meeting.

Thanks,
Robin

Robin Moran
Senior Policy Advisor
U.S. EPA, Office of Transportation and Air Quality
2000 Traverwood Dr.
Ann Arbor, MI 48105
(734) 214-4781

Message

From: Moran, Robin [moran.robin@epa.gov]
Sent: 6/15/2020 7:42:13 PM
To: OTAQ Materials [OTAQMaterials@epa.gov]
CC: Charmley, William [charmley.william@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Haugen, David [haugen.david@epa.gov]; Orlin, David [Orlin.David@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Snapp, Lisa [snapp.lisa@epa.gov]; Barba, Daniel [Barba.Daniel@epa.gov]
Subject: FYI: EPA Presentations for the NAS LDV GHG Meeting tomorrow
Attachments: EV Technology_EPA-NAS Meeting June 16 2020.pdf; Economic and Consumer Issues_EPA-NAS Meeting June 16 2020.pdf; Emerging Trends in Transportation_EPA-NAS Meeting June 16 2020.pdf; ALPHA update_EPA-NAS Meeting June 16 2020.pdf; Powertrain Benchmarking_EPA-NAS Meeting June 16 2020.pdf; EV International Issues_EPA-NAS Meeting June 16 2020.pdf; OMEGA overview_EPA-NAS Meeting June 16 2020.pdf; epa - nas agenda_update 6-11-2020.pdf

Dear Sarah,

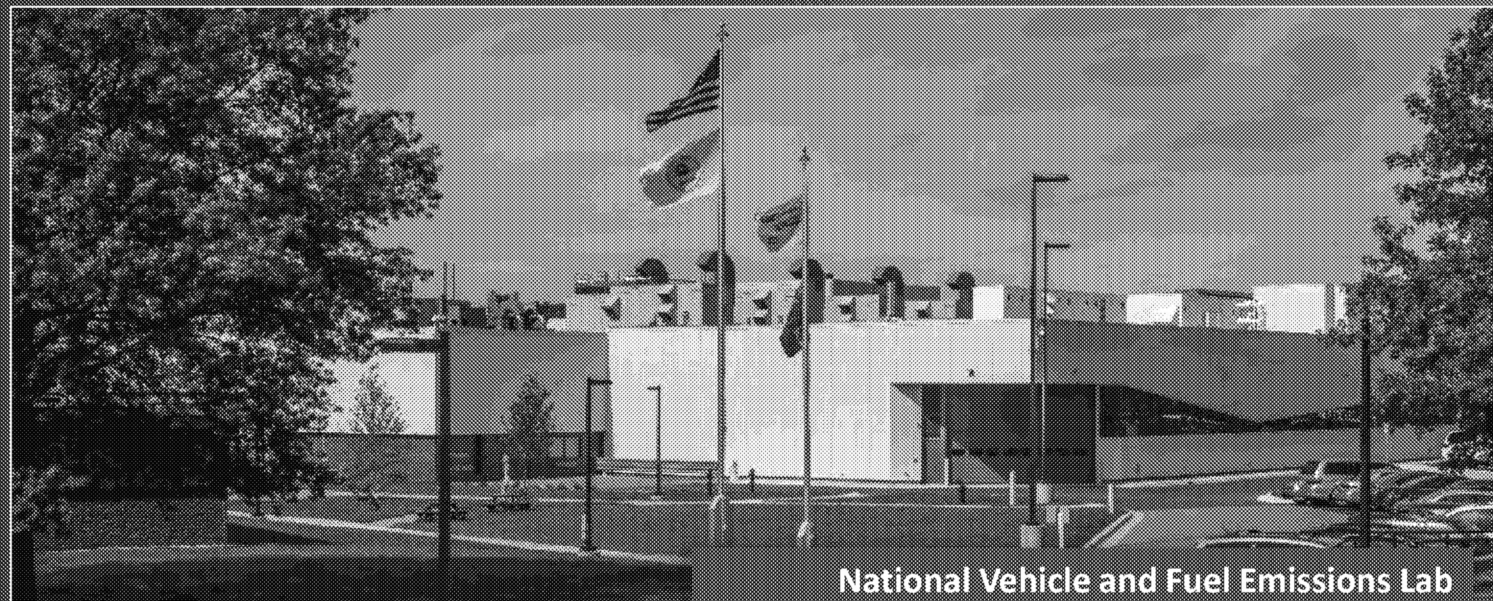
In follow-up to our briefing with you last Friday, we are sending each of the OTAQ presentations that we'll be sharing with the NAS tomorrow. Also attached is the latest agenda.

Thanks for your interest in these materials.

Best,
Robin

Robin Moran
Senior Policy Advisor
U.S. EPA, Office of Transportation and Air Quality
2000 Traverwood Dr.
Ann Arbor, MI 48105
(734) 214-4781

Light-Duty Vehicle
Powertrain Benchmarking and Technology Effectiveness Assessments



National Vehicle and Fuel Emissions Lab
Office of Transportation and Air Quality – Ann Arbor, MI

Dan Barba, Director
National Center of Advanced Technology (NCAT)

Presented to NAS-NRC
on June 16, 2020

Topics

Presented to NAS-NRC
on June 16, 2020

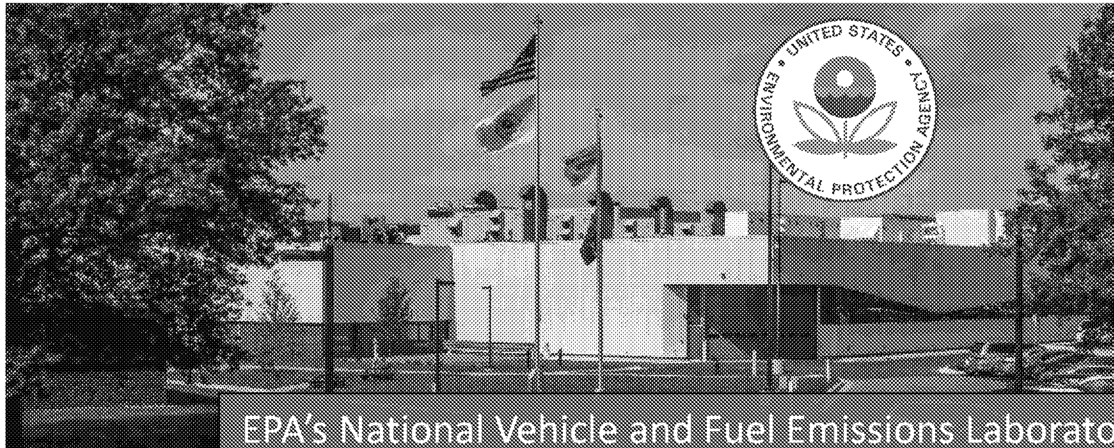
1. **NVFEL Background**
2. **Benchmarking & Technology Assessments**
   - **A. Conventional technology benchmarking**
     - Overview of Conventional Powertrain Benchmarking
     - Review of EPA's ICE benchmarking and analysis
     - Current benchmarking of cylinder deactivation engines
     - Highlights of new ICE's announced at Vienna Motor Symposium
     - Transmissions
     - Acceleration Performance, Fuel Consumption, and Engine Scaling
     - Key take-aways
   - **B. Electrified technology benchmarking**
     - 2017 Chevy Bolt vehicle & e-motor/battery components
     - Effect of temperature on EV range
     - 2018 Jeep Wrangler 48-volt BISG hybrid component
     - Key take-aways
3. **Other Emerging Work**
   - Development of test methods for Connected Automated Vehicles
   - Expansion of In-Use Testing and Data Analysis
4. **Responses to Specific NAS Questions**

EPA's Advanced Technology Testing and Demonstration

NVFEL's National Center for Advanced Technology

NVFEL Background

Presented to NAS-NRC
on June 16, 2020



EPA's National Vehicle and Fuel Emissions Laboratory
Office of Transportation and Air Quality in Ann Arbor, MI

NVFEL is proud to be an ISO certified and ISO accredited lab
ISO 14001:2004 and ISO 17025:2005

NVFEL is a state of the art test facility that provides a wide array of dynamometer and analytical testing and engineering services for EPA's motor vehicle, heavy-duty engine, and nonroad engine programs

- Certify that vehicles and engines meet federal emissions and fuel economy standards
- Test in-use vehicles and engines to assure continued compliance and process enforcement
- Analyze fuels, fuel additives, and exhaust compounds
- Develop future emission and fuel economy regulations
- Develop laboratory test procedures
- **Research future advanced engine and drivetrain technologies (involving modeling, advanced technology testing and demonstrations)**

National Center for Advanced Technology (NCAT)

Publicly Available Data Packets Released on EPA Website*

Available Benchmarking Data

Engine Test Data Packets

- 2018 Toyota 2.5L A25A-FKS Engine Tier 2 & Tier 3 Fuels
- 2016 Mazda 2.5L Turbo Skyactiv-G Tier 2 & Tier 3 Fuels
- 2016 Honda 1.5L L15B7 Engine Tier 2 & Tier 3 Fuels
- 2013 Ford 1.6L EcoBoost Engine Tier 2 & LEV III Fuels
- 2014 Chev. 4.3L EcoTec LV3 Engine Tier 2 & LEV III Fuels
- 2015 BMW 3.0L N57 Engine Diesel Fuel
- 2013 Chevrolet 2.5L Ecotec LCV Engine Reg E10 Fuel
- 2014 Mazda 2.0L Skyactiv Engine Tier 2 & LEV III Fuels
- 2015 Ford F150 2.7L Tier 2 Fuel

Transmission Test Data Packets

- 2018 Toyota Camry 8-speed Transmission (in process)
- 2014 GM 6L80 Transmission
- 2013 Chevrolet Malibu 6T40 Transmission
- 2014 Ram 1500 HFE 845RE Transmission
- 2013 Nissan Jatco CVT8 Transmission

Vehicle Test Data Packets

- 2018 Toyota Camry 2.5L Engine Tier 2 & 3 Fuels
- 2014 Dodge Charger 3.6L Tier 2 Fuel
- 2013 Chevrolet Malibu 1LS Tier 2 & 3 Fuels
- 2013 Mercedes E350 BlueTEC Diesel Fuel

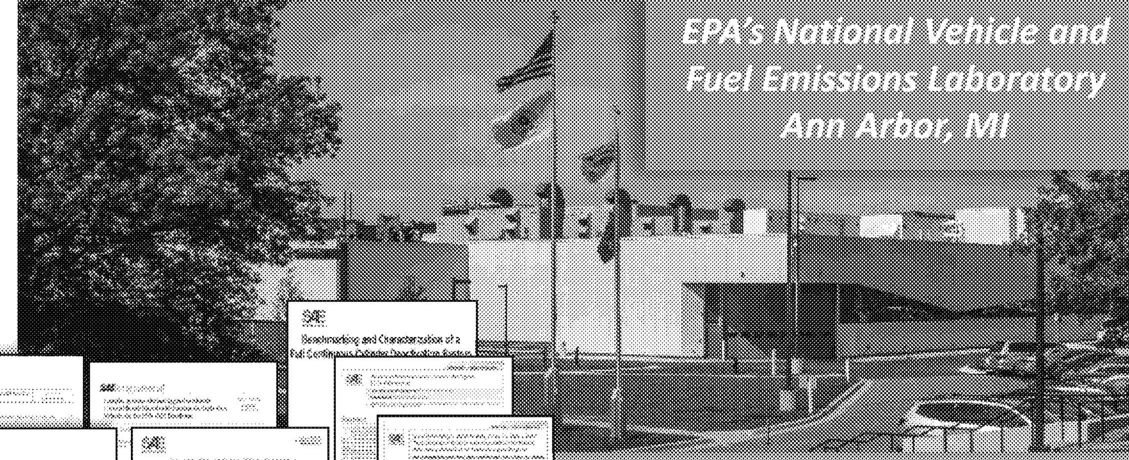
Note: *Additional data packets for a 2016 Honda Civic, 2016 Mazda 6, 2018 Jeep Wrangler, 2015 F-150 and 2014 Silverado with fixed cylinder deactivation are planned, as time permits.*

*Data packets are available at:

- https://www.epa.gov/vehicle-and-fuel-emissions-testing/benchmarking-advanced-low-emission-light-duty-vehicle-technology
- https://www.epa.gov/vehicle-and-fuel-emissions-testing/combining-data-complete-engine-alpha-maps

Presented to NAS-NRC on June 16, 2020

EPA Technical Information Available to All Stakeholders and the Public



Wide range of presentations & peer-reviewed publications:

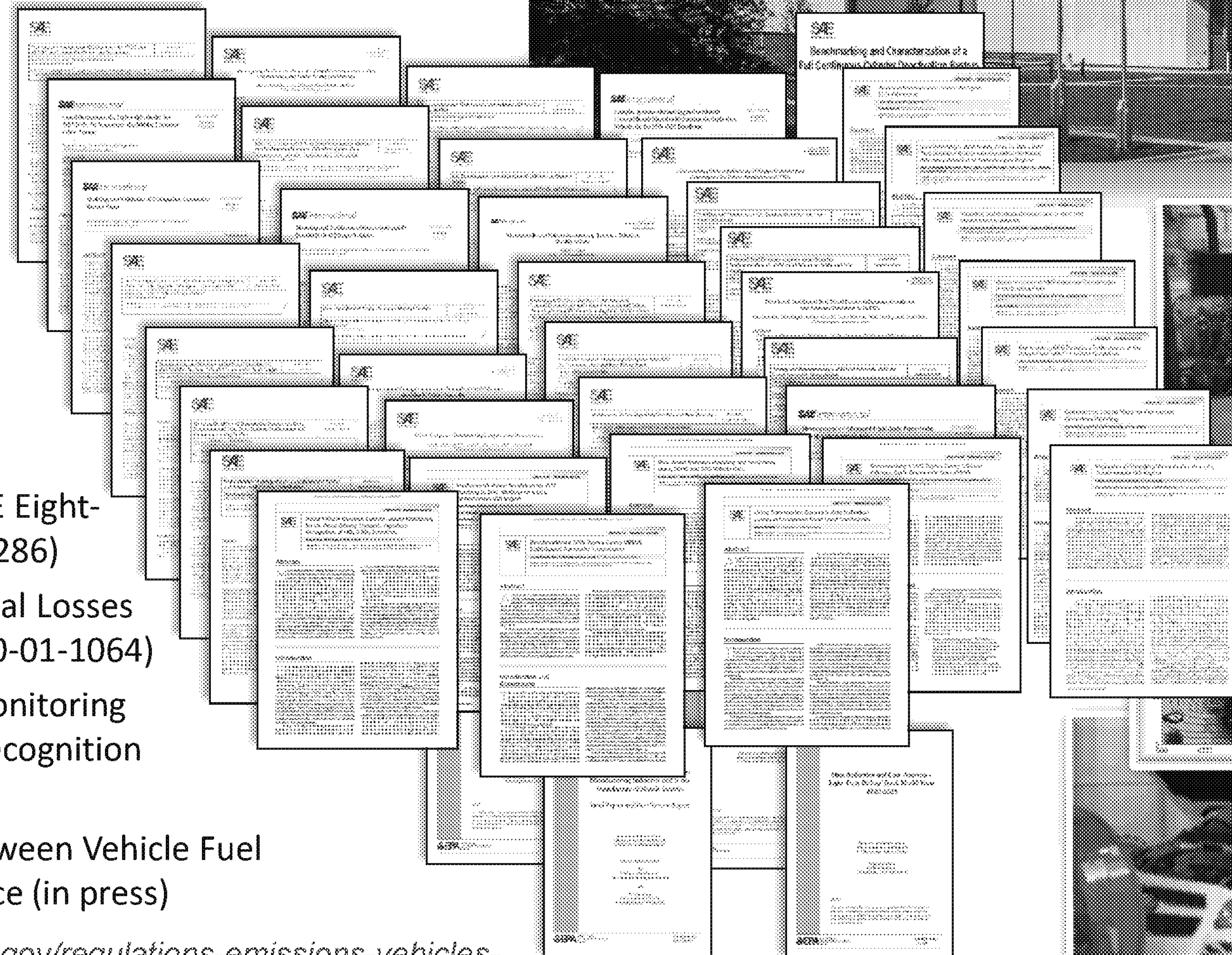
- Conference presentations
- Modeling workshop
- Technical papers*, including SAE papers (38) and reports
- 4 more new papers in 2020

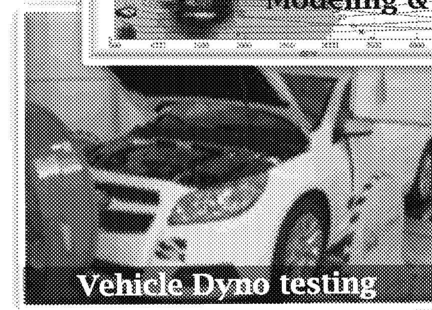
✓ Benchmarking a 2018 Toyota Camry UB80E Eight-Speed Automatic Transmission (2020-01-1286)

✓ Using Transmission Data to Isolate Individual Losses in Coastdown Road Load Coefficients (2020-01-1064)

✓ Motor Vehicle Emission Control Quality Monitoring for On-Road Driving: Dynamic Signature Recognition of NOx & NH_3 Emissions (2020-01-0372)

✓ Assessment of Changing Relationships Between Vehicle Fuel Consumption and Acceleration Performance (in press)





***Available at:** *https://www.epa.gov/regulations-emissions-vehicles-and-engines/midterm-evaluation-light-duty-vehicle-greenhouse-gas*

Presented to NAS-NRC on June 16, 2020

Topics

1. NVFEL Background

2. **Benchmarking & Technology Assessments**

   A. **Conventional technology benchmarking**
      - Overview of Conventional Powertrain Benchmarking
      - Review of EPA's ICE benchmarking and analysis
      - Current benchmarking of cylinder deactivation engines
      - Highlights of new ICE's announced at Vienna Motor Symposium
      - Transmissions
      - Acceleration Performance, Fuel Consumption, and Engine Scaling
      - Key take-aways

   B. Electrified technology benchmarking
      - 2017 Chevy Bolt vehicle & e-motor/battery components
      - Effect of temperature on EV range
      - 2018 Jeep Wrangler 48-volt BISG hybrid component
      - Key take-aways

3. Other Emerging Work
   - Development of test methods for Connected Automated Vehicles
   - Expansion of In-Use Testing and Data Analysis

4. Responses to Specific NAS Questions

Presented to NAS-NRC
on June 16, 2020

Overview of Conventional Powertrain Benchmarking

Conventional Powertrain Benchmarking

- Over the past seven years EPA has undertaken a very thorough technical assessment of conventional vehicle powertrain technologies.
- This assessment included a deep technical dive into **turbocharged engine technology** (culminating with testing of a 2016 Honda Civic L15B7 1.5-liter turbo engine technology) and **naturally aspirated engine technology** (culminating with testing of a 2018 Toyota Camry 2.5-liter A25A-FKS Atkinson-cycle engine with cooled-EGR).
- Transmission benchmarking included **continuously variable transmissions** and **automatic transmissions** (5, 6, 8 and 10 speed transmissions).
- Our benchmarking data is still largely representative of the current state-of-the-art in conventional powertrain technology, with the exception of cylinder deactivation technology.
- With the recent U.S. market launches of products with **advanced cylinder deactivation** technology (like skip-fire), we have started a couple of benchmarking programs to gather data to validate our previous ALPHA modeling assessment of the amount of additional GHG reduction benefit that could be gained with the addition of cylinder deactivation technology.
- Given our solid understanding of conventional vehicle technologies and looking ahead to coming trends in the light-duty market, EPA has shifted its primary benchmarking focus to **electrified** technologies.

Presented to NAS-NRC
on June 16, 2020

Key EPA Conventional Powertrain Benchmarking and Assessments

1. Boosted Engine Technology: *Benchmarked* – 2016 Honda Civic 1.5-liter L15B7 turbocharged engine, includes estimated effect of adding full continuous cylinder deactivation (SAE 2018-01-0319)

   EPA Advanced Boosted Engine Demonstration (ongoing)

2. Atkinson Cycle Engine Technology: *Benchmarked* – 2018 Toyota Camry 2.5L A25A-FKS Atkinson engine with cooled-EGR, includes estimated effect of adding full continuous cylinder deactivation (SAE 2019-01-0249)

3. Cylinder Deactivation Benchmarking (ongoing):
   - *Current Benchmarking* – 2018 Mazda 6 2.5L engine with partial cylinder deactivation
   - *Current Benchmarking* – 2019 Chevy Silverado 5.3L engine with Dynamic Fuel Management *(Tula's Dynamic Skip Fire – full continuous cylinder deactivation)*

4. Spark Controlled Compression Ignition (SPCCI): *Analysis only* – Mazda's 2.0L SPCCI Skyactiv-X Engine with supercharger

5. European ICE Developments

Presented to NAS-NRC on June 16, 2020

Boosted Engine Technology Frontier

SAE 2018-01-0319 *Benchmarking a 2016 Honda Civic 1.5-liter L15B7 Turbocharged Engine and Evaluating the Future Efficiency Potential of Turbocharged Engines*

Key Takeaways

- Engine parameters and technologies have been steadily advancing since 2010
- No engine incorporates all potential technology improvements.
- Significant untapped efficiency improvement potential is still available

Boosted Engines	Intro Year	Variable Valve Timing (VVT)	Integrated Exhaust Manifold	High Geometric CR	Friction Reduction	Higher Stroke/Bore Ratio	Boosting Technology	Cooled EGR	Variable Valve Lift (VVL)	Miller Cycle	VNT/VGT Turbo	Partial Discreet Cylinder Deac.	Full Authority Cylinder Deac.	Variable Compression Ratio	Gasoline SPCCI / Lean Modes
Ford EcoBoost 1.6L	2010														
Ford EcoBoost 2.7L	2015														
Honda L15B7 1.5L	2016														
Mazda SKYACTIV-G 2.5L	2016						[4]				[4]				
VW EA888-3B 2.0L	2018														
VW EA211 EVO 1.5L	2019							?[3]							
VW/Audi EA839 3.0L V6	2018				?[3]										
Nissan MR20 DDT VCR 2.1L	2018			+	?[3]		?[3]	?[3]							?[3]
Mazda SKYACTIV-X SPCCI 2.0L SC[1]	2019			+	?[3]						NA				
EPA/Ricardo EGRB24 1.2L[2]	N/A														

Technology Frontier

yellow = early implementation *light & dark green = nearing maturity* *red = technology not present*

1- Supercharged **2**- EPA Draft TAR **3**- Not known at time of writing

4- Mazda accomplishes equivalent of VNT/VGT using novel valving system

Presented to NAS-NRC on June 16, 2020

EPA Advanced Boosted Engine Demonstration

Project Plan

- Base engine is 2016 Honda L15B7 1.5L
- Add cool EGR system on hand
- Add VGT turbo purchased
- Built GT power model

Status

- Paused due to focus on EPA's Cleaner Trucks Initiative (CTI)
- Plan to resume in FY21 or FY22

Boosted Engines	Intro Year	Variable Valve Timing (VVT)	Integrated Exhaust Manifold	High Geometric CR	Friction Reduction	Higher Stroke/Bore Ratio	Boosting Technology	cooled EGR	Variable Valve Lift (VVL)	Miller Cycle	VNT/VGT Turbo	Partial Discreet Cylinder Deac.	Full Authority Cylinder Deac.	Variable Compression Ratio	Gasoline SPCCI / Lean Modes
Ford EcoBoost 1.6L	2010														
Ford EcoBoost 2.7L	2015														
★ Honda L15B7 1.5L	2016						★	★		★		★			
Mazda SKYACTIV-G 2.5L	2016						4				4				
VW EA888-3B 2.0L	2018														
VW EA211 EVO 1.5L	2019							?3							
VW/Audi EA839 3.0L V6	2018				?3										
Nissan MR20 DDT VCR 2.1L	2018			+	?3		?3	?3							?3
Mazda SKYACTIV-X SPCCI 2.0L SC[1]	2019			+	?3						NA				
EPA/Ricardo EGRB24 1.2L[2]	N/A														

yellow = early implementation *light & dark green = nearing maturity* ***red** = technology not present*

1- Supercharged **2**- EPA Draft TAR **3**- Not known at time of writing

4- Mazda accomplishes equivalent of VNT/VGT using novel valving system

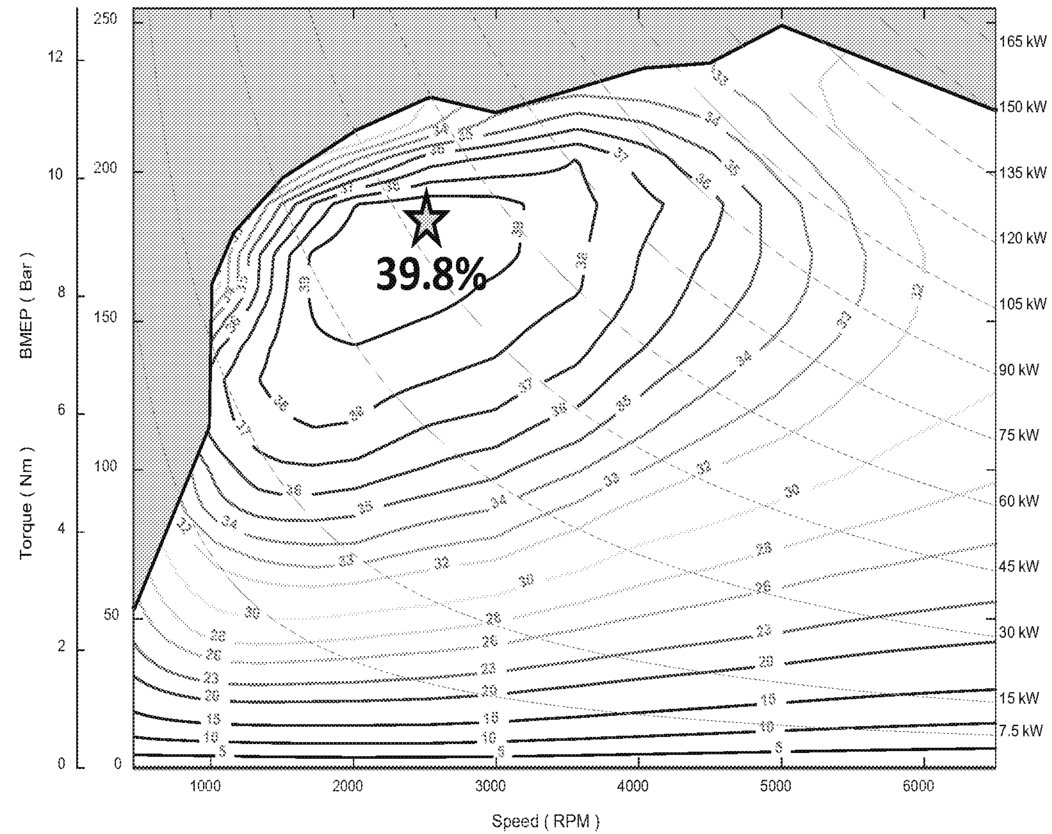
Presented to NAS-NRC on June 16, 2020

EPA Benchmarking of Toyota Atkinson-Cycle Engine with Cooled EGR

- *Benchmarked* – 2018 Toyota Camry 2.5L A25A-FKS Atkinson engine with cooled-EGR
- EPA's 2016 modeling estimate of an Atkinson cooled-EGR concept engine with was within 0.4% of Toyota's eventual 2018 production engine in a 2018 mid-sized exemplar vehicle.

Engine	Sized Engine Displacement	Combined FE	Combined GHG	Combined GHG % Diff
	(liters)	(mpg)	188.9	%
2016 Performance Neutral Baseline Vehicle				
2013 Chevrolet 2.5L Ecotec LCV	2.44 I4	36.9	240.5	
2018 mid-size Exemplar Vehicle				
2014 Mazda SKYACTIV 2.0L 13:1	2.30 I4	43.2	205.8	**0.0%**
Future Atkinson w/14:1 + cEGR (EPA GT-Power model)	2.30 I4	44.9	198.0	**-3.8%**
2018 Toyota 2.5L A25A-FKS 13:1 w/cEGR (EPA Benchmark)	2.26 I4	44.7	198.9	**-3.4%**

2018 Toyota 2.5-liter A25A-FKS engine with cEGR



See SAE paper 2019-01-0249, "Benchmarking a 2018 Toyota Camry 2.5-Liter Atkinson Cycle Engine with Cooled-EGR")

Presented to NAS-NRC on June 16, 2020

ALPHA Estimate of Future Mid-size Vehicle with Toyota Atkinson-Cycle Engine with Cooled EGR plus Cylinder Deactivation

- Estimated the effect of adding full continuous cylinder deactivation technology

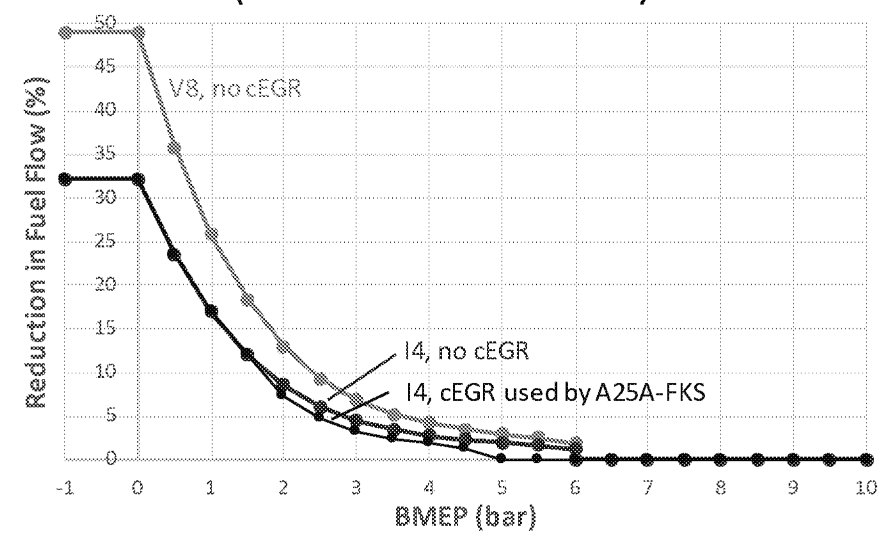
- ALPHA simulations of future mid-size exemplar vehicle show that the addition of cylinder deactivation would significantly improve efficiency.

Future mid-size Exemplar Vehicle (as defined in SAE paper)

Engine	Type of cylinder Deac	Sized Engine Displacement (liters)	Combined FE (mpg)	Combined GHG gCO2/mi	Delta from Mazda %	Effect of Adding Cylinder Deac. %
2014 Mazda SKYACTIV 2.0L 13:1	none	2.09 I4	50.4	176.2	0.0%	
2018 Toyota 2.5L A25A-FKS 13:1 w/cEGR (EPA Benchmark)	none	2.00 I4	52.8	168.4	-4.4%	0.0%
	deacPD	2.00 I4	53.5	166.0	-5.8%	-1.4%
	deacFC	2.00 I4	54.6	162.8	-7.6%	-3.3%
Future EGRB-24 + cEGR (EPA model)	none	1.22 I4	54.6	162.7	-7.7%	

EPA's estimate of effectiveness of full continuous cylinder deactivation

(% reduction of BSFC)



green curve – the L94 V8 engine as measured by EPA
red curve – an I4 engine without cEGR (an I4 engine that is the equivalent of the deacFC effectiveness of the L94 engine)
black curve – an I4 engine with cEGR (further adjusted for the mass flow and temperature of cEGR of the A25A-FKS engine)

See SAE paper 2019-01-0249, "Benchmarking a 2018 Toyota Camry 2.5-Liter Atkinson Cycle Engine with Cooled-EGR"

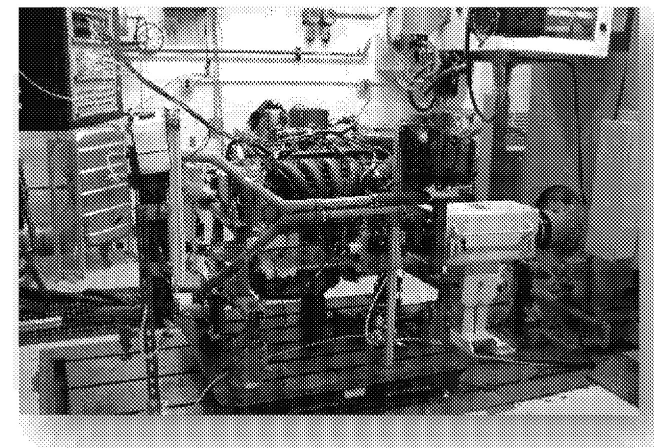
Presented to NAS-NRC on June 16, 2020

Benchmarking Mazda 6 2.5L Engine with Cylinder Deactivation

Progress with Chassis Testing

- Vehicle chassis testing has been completed (includes forcing "no deactivation" operation).
- Spare engine is mounted in test cell, ready for benchmarking
- SWRI to tether car to test cell engine
- Complete engine benchmarking with and without cylinder deactivation

Test Cell Configuration



- Engine's control strategy is fixed 4-cylinder to 2-cylinder cylinder deactivation (CDA)
- We will map the speed/load map in the area where CDA is operational
- We will use valve position sensors to detect valve motion

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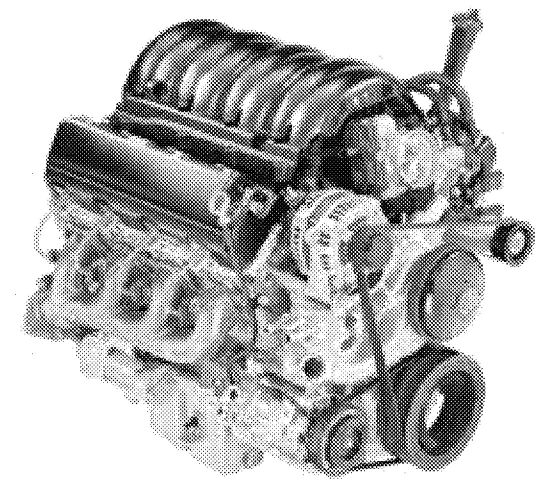
Benchmarking 2019 Chevy Silverado with Cylinder Deactivation



Progress with Chassis Testing

- Factory scan tool authority over Dynamic Fuel Management system (Tula "Skip fire") is more limited than that with the AFM system (fixed cylinder deactivation)
- Break-out-box will be added to monitor critical signals & possibly gain authority over the AFM system.
- Test plan includes 40 tests for Alpha model validation
    - Repeats of 6 different cycles
    - Steady states
    - Mild accel and decel tests
    - Torque converter stall test

5.3L V-8 DFM VVT DI (L84)

- ✓ Cast aluminum block and head
- ✓ CR 11.0:1
- ✓ 355 hp at 5600 rpm
- ✓ 383 ft-lb at 4100 rpm
- ✓ Direct high-pressure fuel injection with Dynamic Fuel Management

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Spark-Controlled Compression Ignition (SPCCI) Technology

- EPA's initial modeling analysis* estimated a potential for a 12.5% efficiency improvement with SPCCI alone, based on Mazda's publicly available data.
- Mazda has not yet disclosed their plans for any US-based design.
- Tier 3 emission standards present a significant challenge for lean burn technology.
- EPA is still considering benchmarking the European version to better understand the technology and its applicability to the US-market.

* https://www.epa.gov/vehicle-and-fuel-emissions-testing/daniel-barba-assessing-efficiency-potential-future-gasoline

Displacement	1,998	cm^3
Compression ratio	16.3: 1	
Max. power	132 (180)/6,000	kW (PS)/rpm
Max. torque	224/3,000	Nm/rpm
Recommended fuel type	95 RON	

European Production Version

- ✓ Marketed in Europe – fall 2019
- ✓ Spark Controlled Compression Ignition (SPCCI)
- ✓ 48-volt P0 mild-hybrid system
- ✓ Extended engine off periods when stopped in traffic
- ✓ 6-speed manual or automatic transmission
- ✓ 10-30% more torque than current SKYACTIV-G 2.0
- ✓ 10% power increase than current SKYACTIV-G 2.0
- ✓ Better fuel efficiency than current SKYACTIV-D

Mazda's Fuel Consumption and CO_2 Emission values

	Body type	Hatchback				Sedan		
	Transmission	6MT	6AT	6MT	6AT	6MT	6AT	
	Powertrain	FWD	FWD	AWD	AWD	FWD	FWD	
WLTP:	wheels							units
Combined fuel consumption	16 inch	5.5	6.2	6	6.6	5.4	6	l/100
Combined fuel economy	16 inch	42.8	37.9	39.2	35.6	43.6	39.2	mpg
CO_2 emissions (combined)	16 inch	125	140	137	149	122	136	g/km
NEDC:								
Combined fuel consumption	16 inch	4.4	5.3	4.7	5.5	4.3	5.2	l/100
Combined fuel economy	16 inch	53.5	44.4	50.0	42.8	54.7	45.2	mpg
CO_2 emissions (combined)	16 inch	100	119	107	123	96	117	g/km

https://www.mazda-press.com/eu/news/2019/revolutionary-mazda-skyactiv-x-engine-details-confirmed-as-sales-start/

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Highlights of the 41ST International Vienna Motor Symposium

(for information about key features on these engines see Appendix)

1. Toyota 1.5L I3 M15A-FKS and M15A-FXE Atkinson-cycle engines
   "The new 1.5 L gasoline engine from the TNGA series", H. Kitadani et al. (2020)

2. Ford EcoBoost 500 - 1.5L I3 GDI turbo engine
   "EcoBoost 500: Taking Award-Winning Technology to the Next Level", C. Weber et al. (2020)

3. Hyundai-Kia Smartstream 1.0L GDI turbo engine
   "The New Hyundai-Kia's Smartstream 1.0L Turbo GDi Engine", K. Hwang et al. (2020)

4. Mercedes M254 GDI turbo engine
   "M254 – the Mercedes-Benz 4-Cylinder Gasoline Engine of the Future", T. Schell et al. (2020)

5. Mercedes-AMG M139 GDI turbo engine
   - Super Sports Cars in the Compact Class; the world's most powerful four-cylinder engine in series production, made in Affalterbach, R. Illenberger et al. (2020)

6. Light-duty diesel engines with dual-SCR dosing system
   (VW 2.0L EA288 and BMW 3.0)
   - "Volkswagen's TDI-Engines for Euro 6d – Clean Efficiency for Modern Mobility", C. Helbing et al. (2020)
   - "The technical concept of the new BMW 6-cylinder 2nd generation modular Diesel engines", F. Steinparzer et al. (2020)

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EPA Benchmarking of Toyota UB80E Eight-Speed Transmission

Test Process

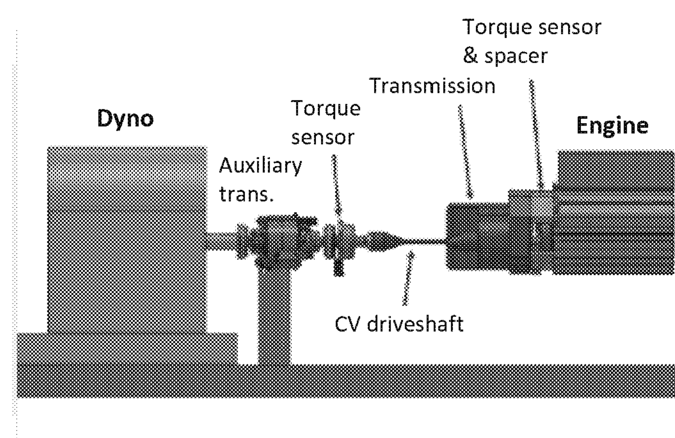
- Transmission tested in engine test cell, connected to the engine and tethered to vehicle.
- Process is relatively inexpensive.
- Uses stock ECU and TCU, so transmission operates as intended and calibrated.

Test data from UB80E

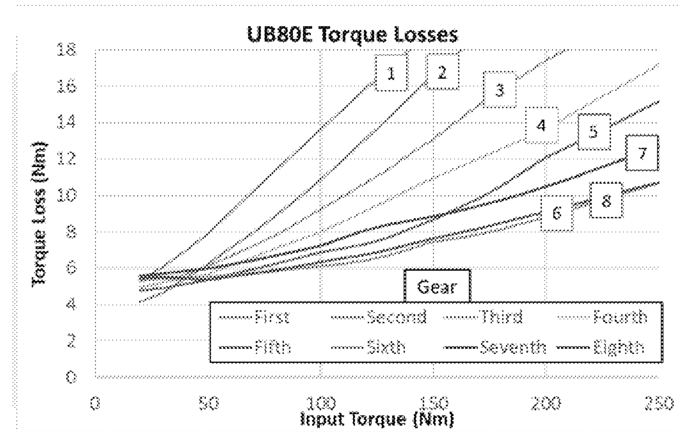
- FWD transmission includes differential losses.
- Tests measured torque losses in each gear, as a function of input speed and torque.
- Other testing including effect of temperature on loss, idle torque, torque converter K factor.

See SAE paper 2020-01-1286, "Benchmarking a 2018 Toyota Camry UB80E Eight-Speed Automatic Transmission."

Test cell schematic



Speed-averaged losses



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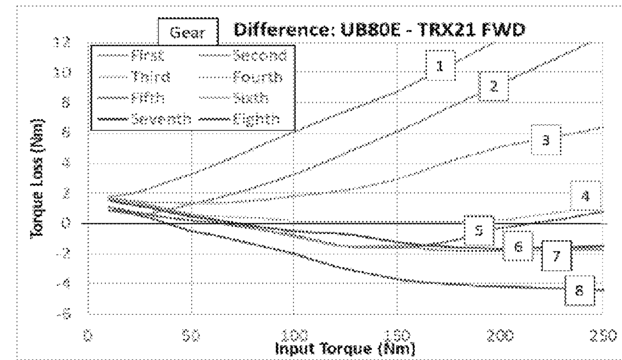
Comparison of Present Benchmarked to Future Transmissions

- Used earlier benchmark data from Chrysler 845RE RWD eight-speed transmission to create an equivalent ALPHA model FWD transmission called **TRX21** by (a) scaling torque losses and (b) accounting for differential loss.
- The future advanced ALPHA transmission called **TRX22** incorporates advanced technology:
  - Wider gear spread
  - Reduced drag torque
  - Earlier torque converter lockup
  - Reduced creep torque
  - Reduced oil pump losses
  - Early warm-up

Comparison: UB80E to scaled 845RE



Simulate transmissions in ALPHA for future CO_2 reduction

- Using Toyota Camry vehicle parameters and Toyota engine map…
  - Toyota UB80E performs very similarly to TRX21 transmission
  - TRX22 transmission shows potential for up to 7% CO_2 reduction in this application *(however, transmission effectiveness depends on engine and vehicle parameters).*
- Earlier work outlined in the 2016 Proposed Determination suggests ~4.5% is closer to center of range of potential effectiveness with the additional cost of a TRX22 transmission over a TRX21 transmission estimated at about $250.

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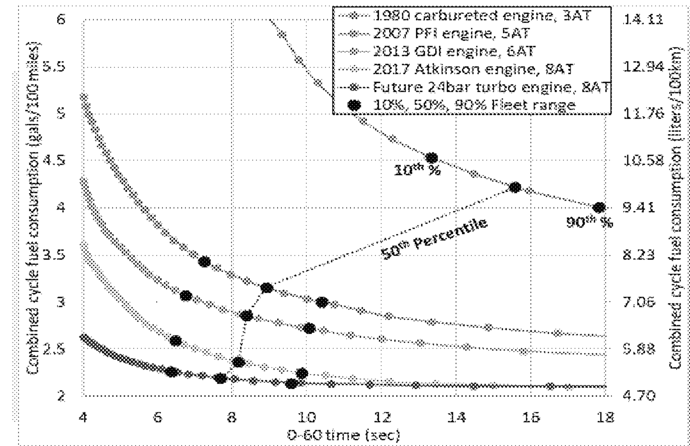
Acceleration Performance, Fuel Consumption, and Engine Scaling

Modeling study with multiple generations of powertrains

- Powertrains become more efficient over time.
  - High-efficiency areas become broader.
  - Efficiency does not fall off as sharply at lower power.
  - Acceleration – fuel consumption tradeoff "flattens."
- Meanwhile, average acceleration has increased.
  - Nominal performance shifts down the tradeoff curve.
  - Tradeoff slope (elasticity) has remained roughly the same.
- However, future powertrains produce much flatter curves.
  - Acceleration increase is unlikely to increase to keep up.
  - In the future, it is likely that increasing or reducing performance will have a reduced effect on CO_2.
- The effect is accentuated in more aggressive driving, so it may already be occurring in real-world cycles.

See in-press SAE paper, "Assessment of Changing Relationships Between Vehicle Fuel Consumption and Acceleration Performance."

Combined FTP-HW



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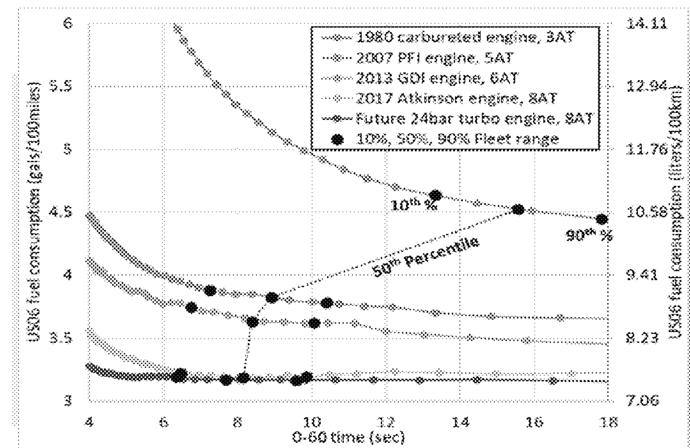

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Key Take-Aways for Conventional Technologies

Conclusions

- All the individual technologies EPA is evaluating are already in production, though some are at an earlier stage of implementation (e.g., advanced turbos, spark controlled compression ignition).
- Large emissions reductions could be achieved by implementing available technologies throughout the fleet (e.g., full implementations of Atkinson cycle, cylinder deactivation, cooled EGR, etc.)
- No engine currently incorporates all potential technology improvements in combination (e.g., Miller cycle + advanced turbo + cylinder deactivation and Atkinson cycle + cylinder deactivation).
- There are also promising advanced engine technologies that have not yet been introduced into the U.S. market, including spark controlled compression ignition.
- Transmissions also have potential to incorporate packages with multiple technology improvements.
- As future powertrains become more efficient, the effect of changing engine power (and acceleration performance) on CO_2 production decreases.

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Topics

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2. Benchmarking & Technology Assessments
   A. Conventional technology benchmarking
      - Overview of Conventional Powertrain Benchmarking
      - Review of EPA's ICE benchmarking and analysis
      - Current benchmarking of cylinder deactivation engines
      - Highlights of new ICE's announced at Vienna Motor Symposium
      - Transmissions
      - Acceleration Performance, Fuel Consumption, and Engine Scaling
      - Key take-aways

   B. Electrified technology benchmarking
      - 2017 Chevy Bolt vehicle & e-motor/battery components
      - Effect of temperature on EV range
      - 2018 Jeep Wrangler 48-volt BISG hybrid component
      - Key take-aways
3. Other Emerging Work
   - Development of test methods for Connected Automated Vehicles
   - Expansion of In-Use Testing and Data Analysis
4. Responses to Specific NAS Questions

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on June 16, 2020

2017 Chevy Bolt Vehicle & e-Motor/Battery Components

Electric Vehicle (EV) Benchmarking

Investigate how to benchmark an EV

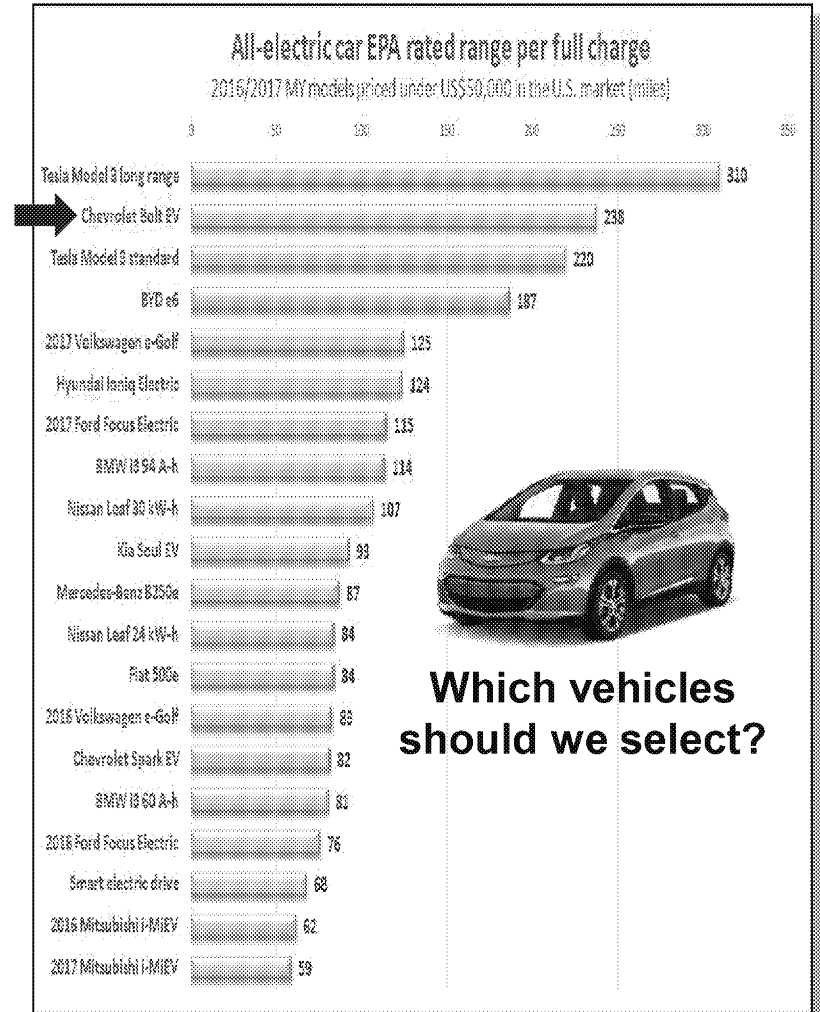
a) What components are involved?
b) How to instrument components?
c) Where to test (chassis, engine dyno cell, etc.?)

What information is useful?

a) <u>Mechanical efficiency</u> of gears & electric motor
b) <u>Electrical efficiency</u> of inverter and battery (including charging eff. of battery and charger)
c) <u>Battery durability</u> (reduction in range) and <u>temperature management</u>
d) <u>Parasitic losses</u> from other vehicle systems (HVAC, controls and lighting)
e) Other?

What are data used for?

a) Full validation modeling of EV submodel for future versions of ALPHA and OMEGA
b) Institutional knowledge and inform EPA policy
c) Informing the public (SAE papers)



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Testing/Safety

Electric Vehicle (EV) Benchmarking

Types of Testing	Safety Concerns
Chassis a) Full signal interrogation by RPECS b) Some instrumentation c) Cycle testing ("City/Hwy/US06 test – 60mph cruise", repeat at mid SOC, repeat at end SOC)	**Chassis** a) Normal vehicle testing safety
Engine dyno a) Tether powertrain to car and battery b) Tether powertrain and battery to car c) Full instrumentation d) Steady-state and transient? **Component testing** a) Battery b) E-motor c) Transmission	**Engine dyno & Component** a) High voltage wiring and connections b) Battery containment for testing (best practices) c) Substitute AVL emulator for battery?

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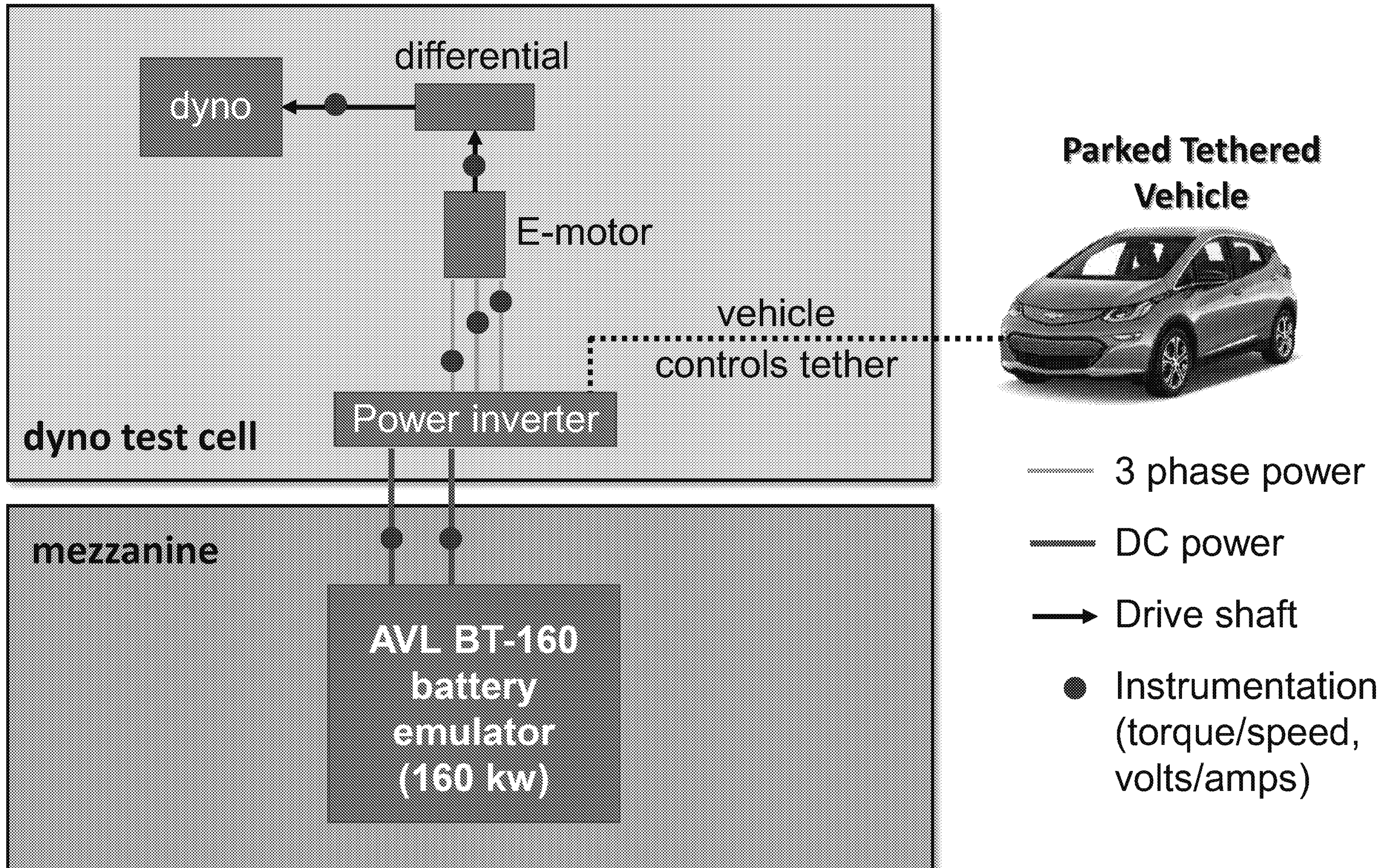
Engine Test Cell Configuration

Bolt e-Motor Drivetrain Testing

(without battery)



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Configuration within Battery Test Facility (no dyno needed)

Stationary Battery Testing

- Add capability to run the draft J1634 Short Multi Cycle Test (SMCT) in the Battery Test Facility (see next slide)
- Evaluate using the AV-900 as a fast DC charger
- Explore battery durability testing methods

Battery Test Facility (BTF) SHED

battery remains in vehicle

battery cooling is needed

Some vehicle controls tethering may be needed

DC power flow

Battery Emulator - AeroVironment AV-900

1) Simulate vehicle drive cycles (starting with J1634 test*) using data from vehicle dyno testing
2) Use as a fast DC charger for battery charging studies

DC power ● Instrumentation (volts/amps)

J1634 draft Multi Cycle Test (vehicle dyno based) will be run to gather battery power profiles for SMCT and other BTF AV-900 simulations.

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SAE J1634 – Battery Electric Vehicle Energy Consumption & Range Test Procedure

Draft EV Test Procedure

Defines test procedures and equipment to be used to accurately measure vehicle energy consumption and range for standard drive cycles (e.g., UDDS & HWY).

- First issued in 1993, the procedure has undergone multiple revisions:
  - ✓ Improve test procedures to reduce dynamometer time
  - ✓ Addition of 5-cycle testing & calculations

Single Cycle Test (SCT) is the legacy procedure.

- Requires operation of the vehicle over repeated drive cycles until the battery is depleted.
- Extremely time consuming, e.g., UDDS test for a 400 mile range vehicle requires more than 26 hours of dynamometer time.

Multi Cycle Test (MCT) was introduced to allow energy & range consumption for multiple drive cycles (e.g., UDDS & HWY) with one full depletion test.

- Significantly reduced amount of dynamometer time required and eliminated one recharge event.

Short Multi Cycle Test (SMCT) is currently under consideration by SAE committee.

- SMCT includes the use of a battery cycler to further reduce the amount of dynamometer time required to deplete the battery.
- SMCT is included in current draft document and will be voted on by the committee later this year.

There is still an open issue on how to incorporate CAN data acquisition into J1634 (EVs) and **J1711** (PHEVs).

- Investigations continue on incorporating CAN data as part of these test procedures.
- NVFEL has collected both CAN and power analyzer data on multiple vehicles over the past several years as part of these investigations.
- Use of CAN data could eliminate the need for instrumenting vehicles for current and voltage measurement during the discharge portion of the test.

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Chevy Bolt Battery

Battery System Components

(1) High Voltage Battery

(2) Heater Coolant Heater

(3) High Voltage Battery Disconnect Control Module Assembly

(4) Accessory DC Power Control Module

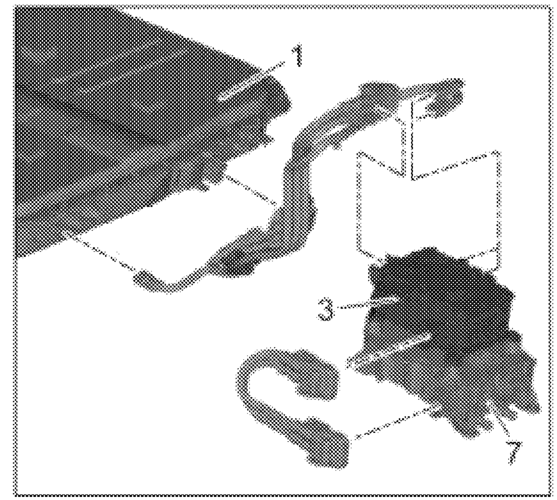
(5) Drive Motor Battery Charger

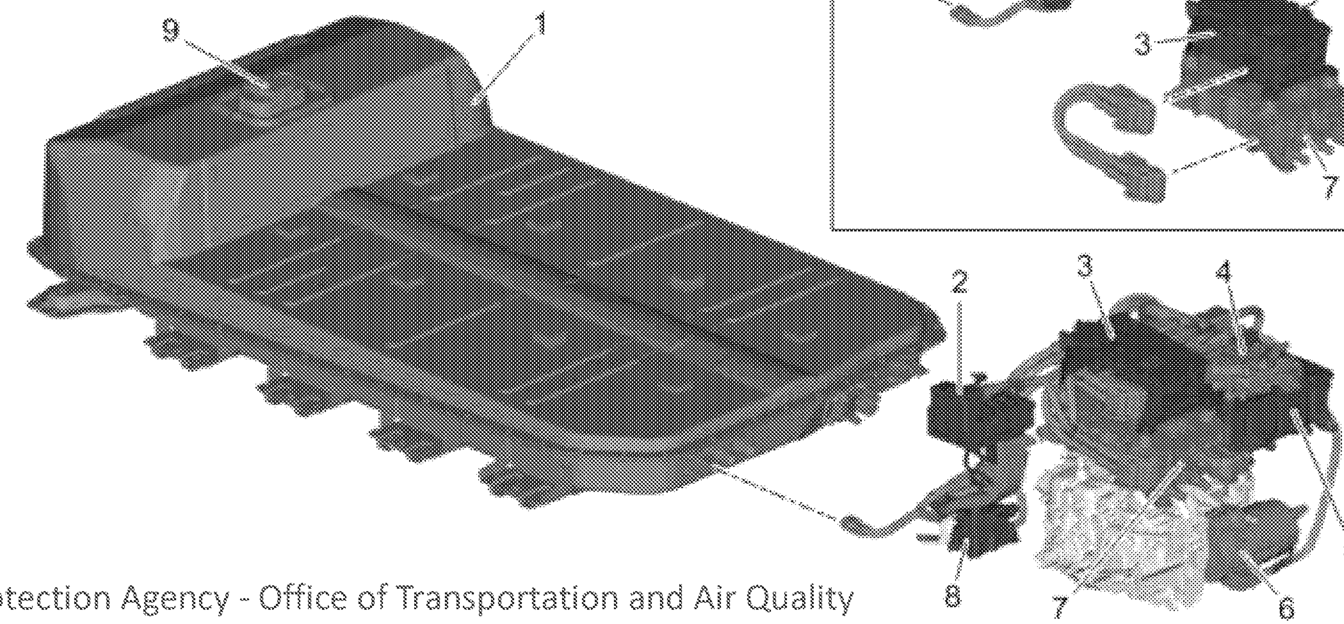
(6) Air Conditioning and Drive Motor Battery Cooling Compressor

(7) Drive Motor Inverter Module

(8) High Voltage Battery Heater

(9) Drive Motor Battery High Voltage Manual Disconnect Lever





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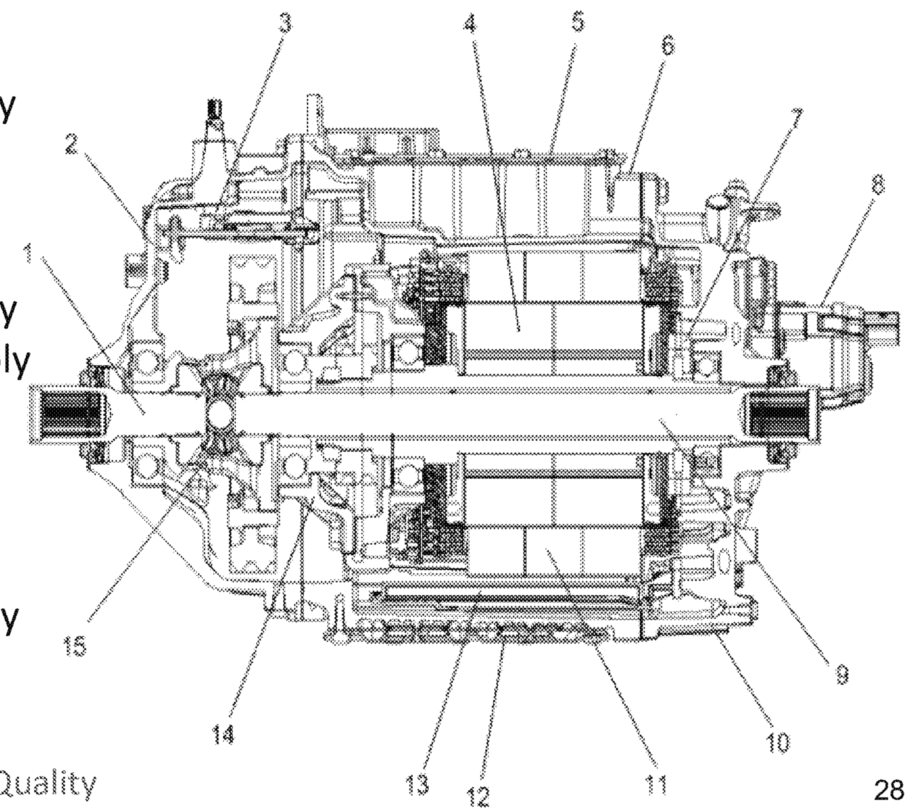
Transmission Components

- Consists of E-motor and single gear reduction
- Investigate how to separate e-Motor from gear drive to install torque sensor
- Purchasing salvage unit for tear down & design concepts
- Will tether the transmission to vehicle

(1) Output Shaft Assembly (RHS)
(2) Automatic Transmission Case
(3) Manual Shift Shaft Position Switch Assembly
(4) Drive Motor Rotor Assembly
(5) Shift Shaft Cover (Oil Sump)
(6) Drive Motor Housing
(7) Drive Motor Position Sensor Stator Assembly
(8) Automatic Transmission Fluid Pump Assembly
(9) Output Shaft Assembly (LHS)
(10) Automatic Transmission Case Cover
(11) Drive Motor Stator Assembly
(12) Shift Shaft Cover (Coolant Sump)
(13) Automatic Transmission Fluid Filter Assembly
(14) Center Support
(15) Front Differential Assembly



Chevy Bolt Transmission Components

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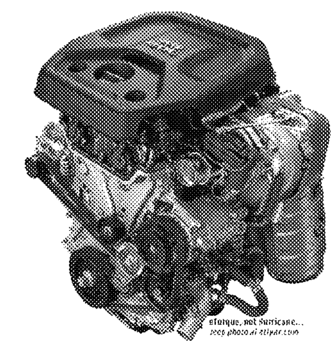
2018 Jeep Wrangler with 48-volt eTorque

Chassis Testing

- CAN reverse engineering completed by SwRI this past spring
- Includes 140 signals across 10 modules
- Vehicle also equipped with a Yokogawa power analyzer for discrete measurement of high voltage battery currents
- Chassis testing is nearly complete
- Test plan includes 40 tests for Alpha model validation
    - Repeats of 6 different cycles
    - Steady states
    - Mild accel and decel tests
    - Torque converter stall test
    - Testing ~50% complete
- Plan to use mild hybrid validation to complete SPCCI assessment

Jeep Wrangler with eTorque

- **2.0 L GME-T4**
    - 270 hp (100 kW/L) @ 5250 RPM
    - 295 ft-lb / 400 Nm @ 4400 RPM
    - 25.1 bar BMEP
    - Cooled EGR
    - Twin-scroll, low-inertia turbocharger
- **48 V BiSG "eTorque"**
    - Start-stop & e-Assist at low vehicle speeds
        - Typical torque assist likely between idle and 1500 RPM and during gear shifting
    - 90 Nm of torque
- **48 V Lithium-Ion Battery Pack**
    - Nickel Manganese Cobalt (NMC)
    - 330 Wh capacity
    - Air cooled
- **Premium Fuel Recommended**



SwRI POWERTRAIN ENGINEERING swri.org 7

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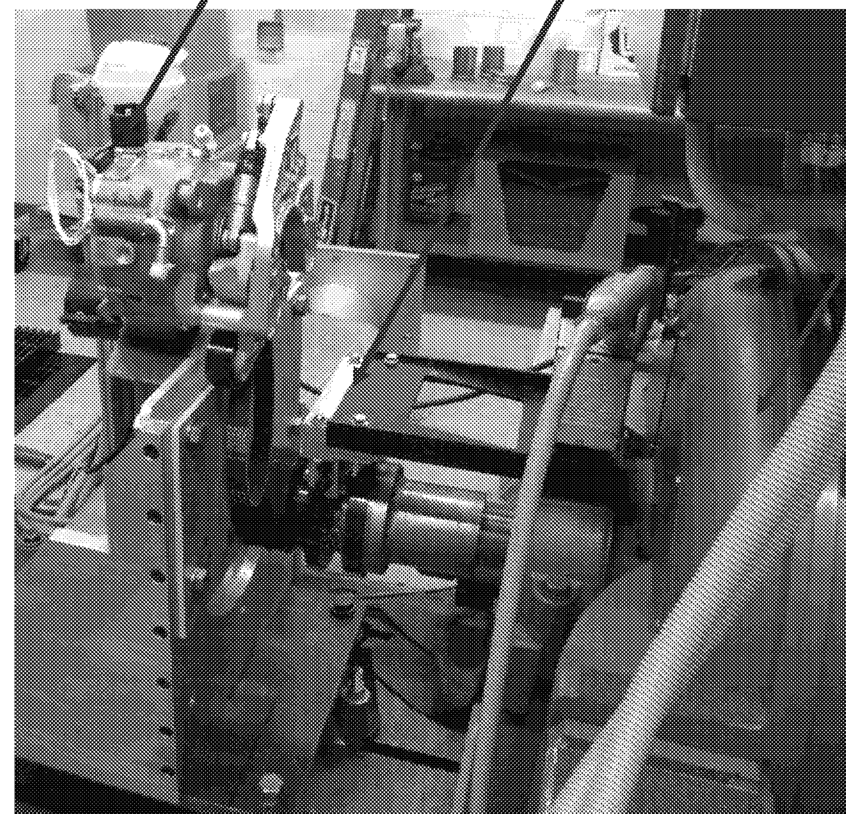
e-Motor Benchmarking Process

2018 Jeep Wrangler with 48-volt eTorque

- Mount e-Motor (starter / generator) to dyno bed plate in cell 12
- Measure speed and torque with HBM torque sensor
- Use AVL battery emulator for load
- Replicate vehicle CAN message controls to operate e-Motor



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Background, Goals & Data

Testing EVs in Hot & Cold Temperatures

Battery electric vehicle driving range decreases in both hot and cold temperatures.

- However, the extent of range loss is not well quantified or understood.
- EPA plans to test light-duty electric vehicles to quantify energy demand in the vehicle.

Primary goal: Quantify the relationship between temperature and energy.

Secondary goal: Quantify trends for extrapolation of energy demand across technologies & vehicles.

Primary data: Discharge energy, range, auxiliary load, recharge energy & time.

Potential additional data and testing:

- Data on HVAC energy consumption (off-cycle credit implications).
- Energy consumption at idle and at various states of charge (affected by thermal management systems).
- Reliability of CAN data compared to measured energy.
- Impact on battery durability, especially at higher mileage.

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EV Benchmarking Study will Quantify Energy Consumption

Test Plan: Level 2 charging & range-depletion discharge using the hot and cold chassis dyno sites.

- Across a range of temperatures (20°F-95°F)
- Dedicated to auxiliary loads (cabin cooling, heating, and alternative heating)
- At charging/soak/preconditioning conditions (garage conditions v. outdoor temperatures)

Testing EVs in Hot & Cold Temperatures

Potential vehicles:

Year	Model	Range (mi)	MPGe (city/hwy)	Battery (kWh)	Power (hp)	Weight (lb)	2019 MSRP
2019	Audi e-tron	204	74/73	95.0	402	5490	$74,800
2019	BMW i3	153	124/102	42.2	170	2965	$44,450
2018	**Chevy Bolt***	**238**	**128/110**	**60.0**	**200**	**3580**	**$36,620**
2019	Hyundai Kona	258	132/108	64.0	201	3715	$36,950
2019/2018	Nissan Leaf	150	124/99	40.0	147	3433	$29,990
2019/2018	Tesla Model 3	240	138/124	59.5	258	3627	$35,400
2018	**Tesla Model S***	**345**	**101/102**	**100.0**	**518**	**4941**	**$99,990**
2019/2018/2017	Tesla Model X	325	91/95	100.0	518	5421	$84,990
2019/2018/2017	Volkswagen eGolf	125	126/111	35.8	134	3455	$31,895

**Vehicles currently on loan from Transport Canada & Environment Canada.*

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Key Take-Aways for Electrified Technologies

Conclusions

- Given global trends in electrification of the light-duty fleet, the EPA Ann Arbor National Vehicle and Fuel Emissions Laboratory (NVFEL) is building up its capabilities to test and analyze electrified technologies.
- Current EPA NVFEL testing efforts include:
  - Collection of test data to validate EV and mild hybrid technologies in ALPHA
  - Evaluation of temperature effects on EV range
  - Building up lab EV test infrastructure including battery cycling, battery charging, and current measurement
  - Collaboration with industry to evaluate and develop the draft SAE J1634 (EV) and J1711 (PHEV) test procedures

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   - **Development of test methods for Connected Automated Vehicles**
   - **Expansion of In-Use Testing and Data Analysis**
4. Responses to Specific NAS Questions

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Connected Automated Vehicles (CAV) Testing Methods

Connected

Automated

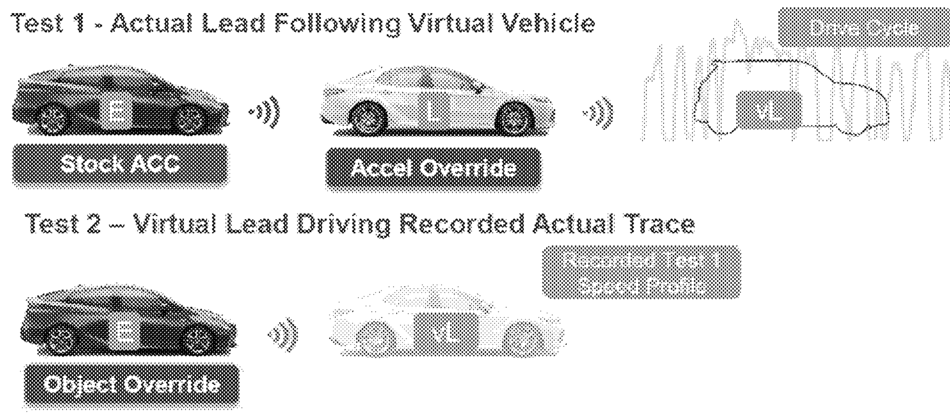
Vehicles

Methods for testing CAVs are being developed at the DOE National Labs

– NVFEL is doing similar work.

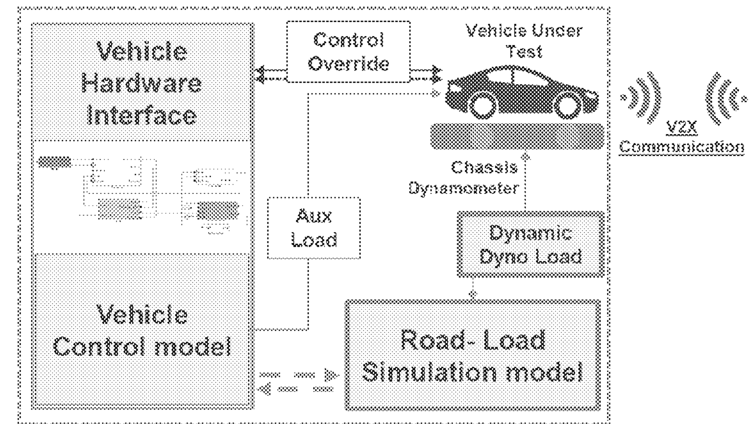
ANL: Vehicle-in the-loop on the track…

Goals: Validate VIL override operation, measure aerodynamic loading.

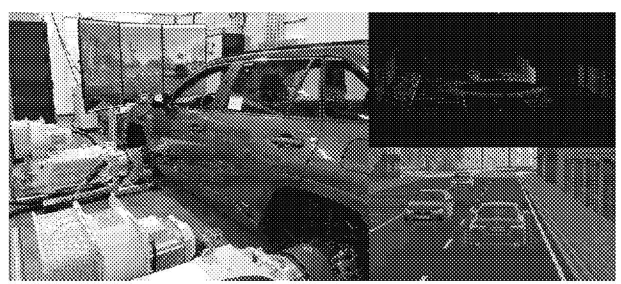


…& ANL: Vehicle in the test cell

Goals: Explore energy use of varying driver models in safe, controlled variation of test parameters.



ORNL: CAVE Lab: Virtual physical proving ground



Goals: Accurately verify large scale energy benefits and emissions impacts of CAV technologies subjected to virtual traffic conditions. Integrate vehicle/traffic simulation tools with advanced HIL enabled laboratories.

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CAV Test Method Development - Testing on a track

Connected Automated Vehicles

Test Vehicle: "Semi-autonomous" with Adaptive Cruise Control (ACC), controlling forward velocity

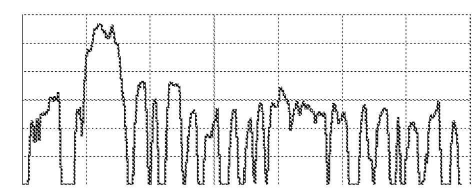
Project Goals - develop test methods to:

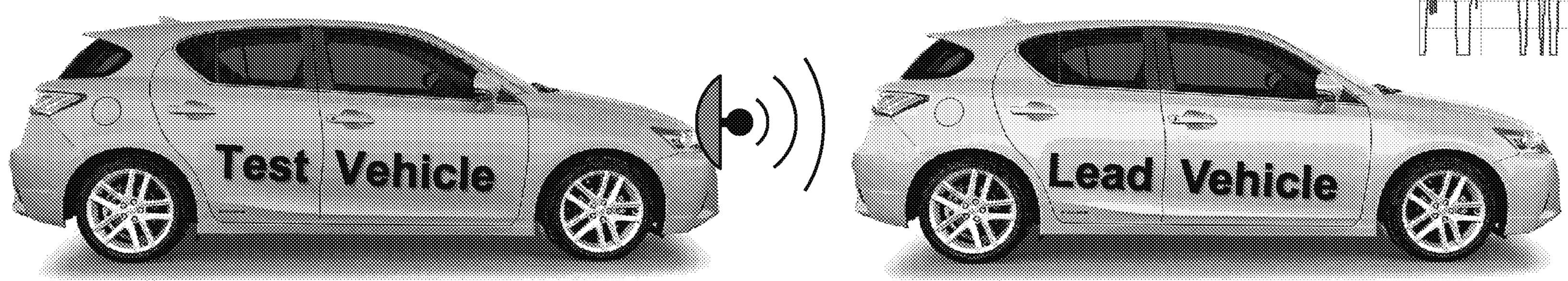
1. Quantify the benefits of ACC in a "real world" setting.
2. Define a lead cycle so the test vehicle mimics a cert cycle.
3. Repeatably drive a lead vehicle for the test vehicle to follow.
4. Determine the repeatability of the test results from the ACC vehicle.
5. Quantify the difference between ACC and a human driver?

Method Development:

- "Leader" vehicle repeats the defined trace.
- Test vehicle follows in ACC mode
  (may be repeated with different following distances).
- Test vehicle follows, driven by a human driver
  (may be repeated with different drivers).

Track trace follower:
Lead vehicle has equipment installed to repeat trace.
- Could use robot driver.
- Need to address safety.





Presented to NAS-NRC
on June 16, 2020

Connected Automated Vehicles

CAV Test Method Development - Testing on a vehicle dynamometer

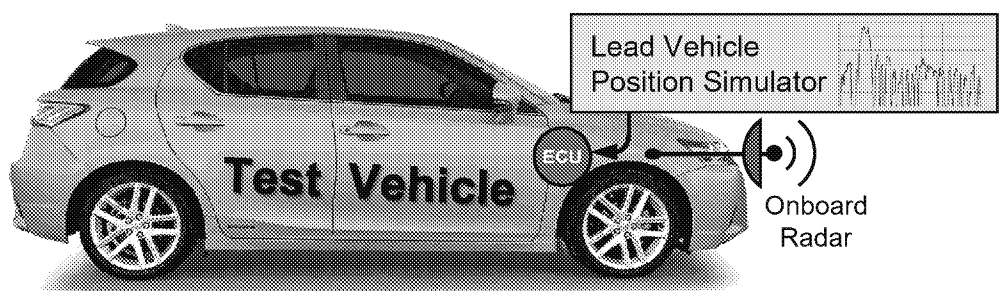
Test Vehicle: "same semi-autonomous" with (ACC), controlling forward velocity

Project Goals - develop test methods to:

1. "Replicate" autonomous behavior and emissions in the lab.
2. "Spoof" vehicle sensors to insert a pre-recorded signal.
3. Quantify how closely a human on-dyno driver can replicate the on-road trace.
4. Compare and contrast results to cert cycle results.

Methods to gather data on vehicle behavior & emissions:

- "Spoof" vehicle sensors to replicate pre-recorded ACC trace.
- Human driver replicates human-driven trace from track.
- Human driver replicates ACC trace.
- Computationally construct and test a "standard human driver" trace.
- Run cert cycle for comparison.



CAN Spoofing:
Radar sensor output is replaced with "spoof" of data recorded earlier.

- Direct wiring into CAN bus.
- Replaces signal from onboard radar.
- Usable with any radar frequency.

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Expansion of In-Use Testing and Data Analysis

In-Use Data Availability

EPA is expanding in-use emission data programs to identify gaps in our understanding of on-road emissions and opportunities for emission reductions.

- The EPA lab has active programs to assess the potential of low cost mini-PEMS devices to expand the number of on-road vehicles tested (advancements in miniature portable emission measurement systems would enable testing on a much broader scale at significantly lower cost.
- NCAT is collaborating with CARB to assess data from their Real Emissions Assessment Logging (REAL) program.
- EPA continues to explore additional collections of OBD-based vehicle and fleet data for light- and heavy-duty.

Topics

1. NVFEL Background
2. Benchmarking & Technology Assessments
   A. Conventional technology benchmarking
      - Overview of Conventional Powertrain Benchmarking
      - Review of EPA's ICE benchmarking and analysis
      - Current benchmarking of cylinder deactivation engines
      - Highlights of new ICE's announced at Vienna Motor Symposium
      - Transmissions
      - Acceleration Performance, Fuel Consumption, and Engine Scaling
      - Key take-aways
   B. Electrified technology benchmarking
      - 2017 Chevy Bolt vehicle & e-motor/battery components
      - Effect of temperature on EV range
      - 2018 Jeep Wrangler 48-volt BISG hybrid component
      - Key take-aways
3. Other Emerging Work
   - Development of test methods for Connected Automated Vehicles
   - Expansion of In-Use Testing and Data Analysis
4. **Responses to Specific NAS Questions**

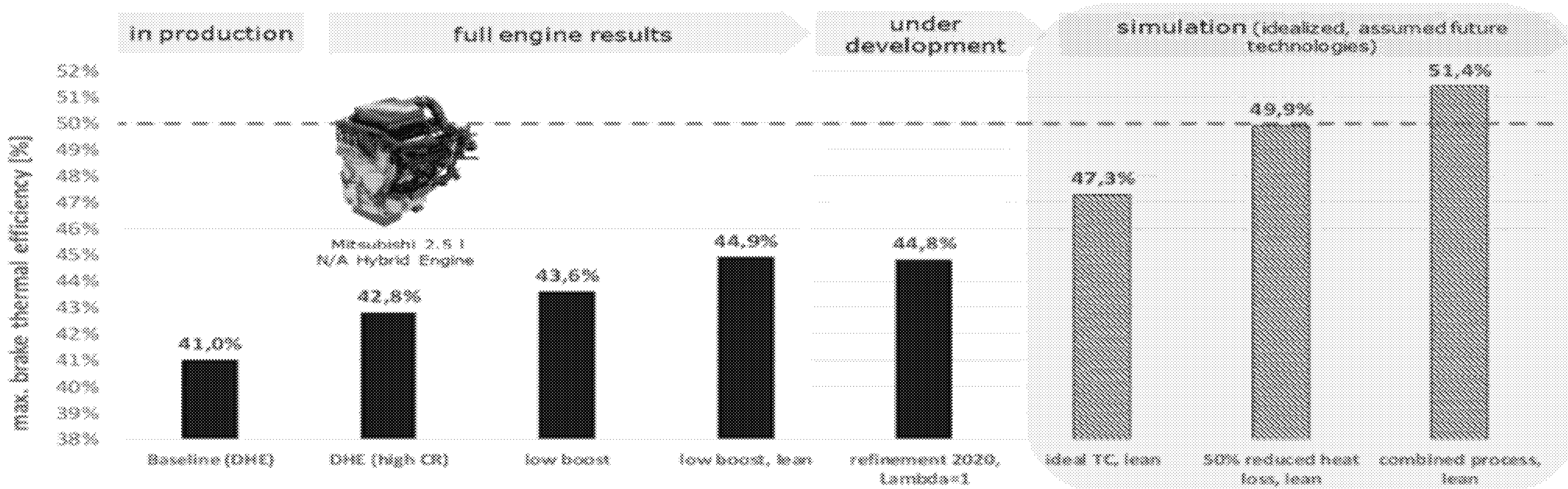
Presented to NAS-NRC
on June 16, 2020

Responses to Specific NAS Questions

7a. **…** it appears that the trend of GTDI engine efficiency developments lean toward higher Miller Cycle potentially with some combination of cooled LP-EGR, VGT to provide expanded boosting requirements, some sort of VVL or cam profile switching to manage pumping losses. … **Does EPA agree with this general direction and is there further quantification of the potential of a similar technology bundle (as proposed follow on in SAE 2018-01-423)?**

EPA response: Yes, we agree that there is additional potential to improve the efficiency of GTDI engines via Miller Cycle (either EIVC or LIVC), VNT or other boosting system improvements, VVL (continuous or discrete), increased charge motion, reduced friction (offset crankshaft, improved bore finishing, etc.), and use of cooled EGR. The engine model developed in SAE 2018-01-0161 was validated with engine dynamometer testing summarized in SAE 2018-01-1423. The developmental engine reached a peak BTE of 38.5% during testing. The modeling was extended to include Miller Cycle (EIVC) using VNT with a developmental goal of 40% BTE on the same engine platform (SAE 2019-01-0192).

Kapus et. al (2020) investigated the potential for using Miller Cycle as a dedicated hybrid engine, with 44.8% peak BTE achievable for λ=1 operation. Considering the use of U.S. vs. EU gasoline (i.e., lower AKI fuels) 42-43% peak BTE appears achievable by 2026 for λ=1 operation with developmental advances applied to current Miller Cycle engine designs (e.g., 48V eCharger or VNT, increased charge motion, reduced engine friction, cooled low-pressure EGR).



Kapus, P. et al. (2020) Passenger car powertrain 4.x – from vehicle level to a cost optimized powertrain system. 41st Vienna International Motor Symposium

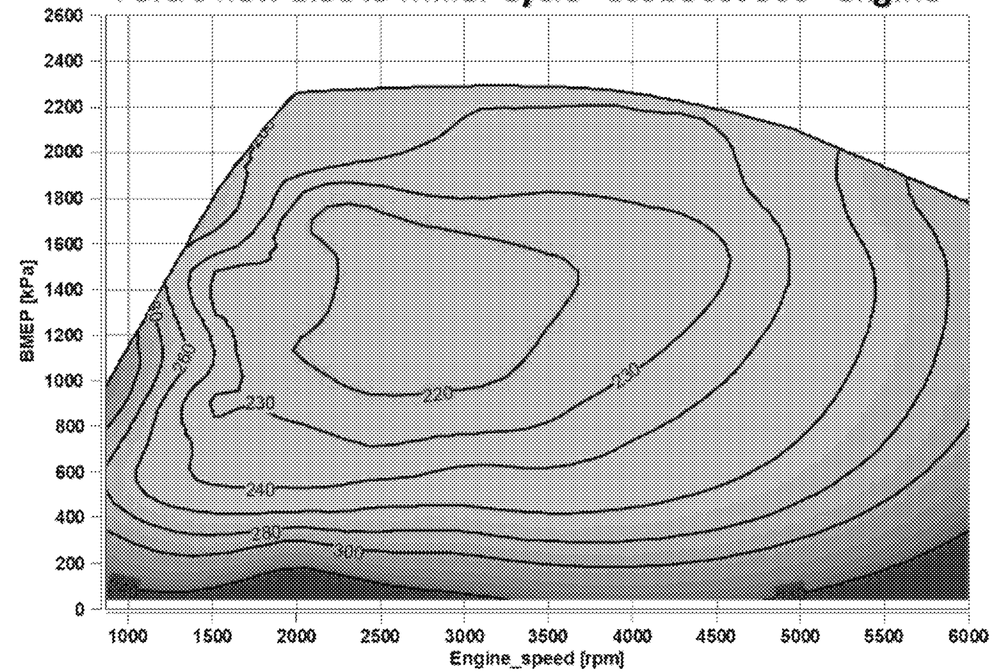
Presented to NAS-NRC on June 16, 2020

Responses to Specific NAS Questions (continued)

7b. Does EPA agree that Miller Cycle engines will either be performance limited (as in VW 1.5L EVO) or displacement constrained?

EPA response: For a given boosting system approach, Miller Cycle places additional constraints on the achievable peak BMEP. For a given torque requirement, that means either accepting a lower BMEP level (e.g., increased displacement), using a more advanced boosting system (improved turbo match, switching to VNT) or reducing geometric compression ratio and the resulting achievable expansion ratio. We have observed all three approaches used in production and developmental Miller Cycle engines. Using advanced boosting systems, the achievable BMEP is still quite high.

Ford's new 1.5L I3 Miller Cycle "Ecoboost 500" engine



Weber, C. et al. (2020) EcoBoost 500 : Taking Award-Winning Technology to the Next Level. 41st Vienna International Motor Symposium.

We were able to maintain the 21 bar BMEP on the developmental PSA EP6 platform using VNT with EIVC. AVL has demonstrated Miller Cycle Concepts with 24 bar BMEP. Ford's new 1.5L I3 Miller Cycle "Ecoboost 500" engine developed for the EU market has a geometric compression ratio of 12.5:1 and reaches 23-bar BMEP using a VGT (Weber et al. 2020). The BMEP level achieved is comparable to Ford's existing line of light-duty Ecoboost engines.

Presented to NAS-NRC on June 16, 2020

Responses to Specific NAS Questions (continued)

8a. Does EPA believe that the technologies included in Table 9 of SAE 2018-01-0319 still represents a comprehensive look ahead for our study timeframe (2025-2035)?

EPA response: Yes. We continue to see new engines with cooled EGR, variable valve lift, Miller Cycle, improved turbos and also more advanced cylinder deactivation technologies being developed and introduced to the market. We expect this to continue as conventional technology engines are still needed to meet fuel economy and emission standards throughout the world market. (see slide 9)

8b. What does EPA believe is the ultimate BTE potential of a practical and cost effective bundle of technologies ("still on the table").

EPA response: We do not yet have a complete answer to this question. Our benchmarking of the Toyota A25A naturally-aspirated Atkinson cycle engine included estimates of effectiveness for both fixed and dynamic cylinder deactivation (SAE 2019-01-0249). Our work on an advanced turbo demonstration engine explored the effectiveness of a cost-effective bundle of technologies, but we have not yet completed the work to determine the bundle's BTE potential. Initial exploratory work (SAE 2019-01-0192) indicated that 40% BTE at peak was achievable but achieving BTE above 40% would have been difficult when considering the age of our developmental engine platform (2012 PSA EP6) and it's hardware limitations (peak cylinder pressure, suboptimal bore-to-stroke ratio, suboptimal port tumble characteristics, lack of IEM, and fuel system limitations).

For EPA to explore this further would require use of a more modern developmental engine platform. Additional developmental work on more advanced Miller Cycle concepts is underway for the EU and other world markets (e.g., Kapus et al. 2020, Weber et al. 2020). Based on published data and when considering the use of U.S. (i.e., lower AKI) fuels, 42% peak BTE appears to be achievable by 2026 with developmental advances applied to current Miller Cycle engine designs for full range operation with $\lambda=1$ operation. A peak BTE of 43% appears achievable for dedicated hybrid engines with $\lambda=1$ operation. If octane improvements are included that are comparable to fuels available in the EU, this could be expected to increase to 43 – 45% peak BTE for $\lambda=1$ operation based on engines currently under development.

Presented to NAS-NRC on June 16, 2020

Responses to Specific NAS Questions (continued)

9. Does EPA believe in the future viability of any sort of lean combustion technology against the constraints of Tier 3 emissions?

EPA response: Mazda is already in production with the Skyactiv-X in the European market, however there are considerable challenges with respect to bringing lean-burn combustion technologies into compliance with the fully phased-in Tier 3 NMOG+NOx standards, which will require NOx reduction efficiency of 99% or greater even when considering engines with relatively low engine-out NOx emissions. EPA is gaining experience with dual-SCR systems capable of achieving this level of NOx control for lean combustion as part of our development of the heavy-duty Cleaner Trucks Initiative program. Such systems are feasible in the 2026-2027 timeframe for commercial applications and perhaps the upper end of the light-duty market in the U.S. (e.g., large light-duty diesel pickups and separate-frame SUVs) but would face considerable cost pressure from competing technologies (electrification, hybridization, advanced gasoline concepts at $\lambda=1$) in smaller light-duty vehicle applications (e.g., passenger cars, CUVs, unibody SUVs)

10. Much of the ICE development presented at the Aachen powertrain conference focused on the synergies available in a hybridized powertrain system context. **What are EPA's thoughts on engine in a hybrid in terms of incremental potential, relative to a baseline engine of your definition?**

EPA response: Based on Toyota's and Hyundai's published data *(see appendix slides 47-48 and 50-51)* manufacturers have made the effort to make incremental engine improvements to achieve higher BTE for HEV applications. Toyota previously published that they obtained an extra 1% peak efficiency on the hybrid version of their Atkinson engine. Other dedicated hybrid engines also show a 1-2% improvement relative to nonhybrid versions (e.g., Mitsubishi 2.5L, Honda 2.0L). A peak BTE of 45% appears to be achievable for a dedicated hybrid Miller Cycle engine if combined with use of higher octane fuels (Kapus et. 2020).

Presented to NAS-NRC on June 16, 2020

Responses to Specific NAS Questions (continued)

11a. What are future technical transmission opportunities that could contribute to improved fuel economy in the 2025-2035 timeframe?

EPA response: More thorough implementation of transmission advances such as wider gear spread, reduced drag torque, earlier torque converter lockup, reduced creep torque, reduced oil pump losses, early warm-up could still contribute to future fuel economy improvements. *(see slide 21)*

11b. What are the costs and effectiveness of those technologies, relative to an appropriate transmission baseline?

EPA response: Earlier work outlined in the 2016 Proposed Determination indicates the additional cost of a TRX22 transmission over a TRX21 transmission is about $250. Earlier estimates for EPA's future TRX22 transmission shows potential for up to 7% CO_2 reduction depending on specific engine and vehicle parameters. Earlier work suggests ~4.5% is closer to center of range of potential effectiveness. *(see slide 21)*

Questions?

Presented to NAS-NRC
on June 16, 2020

Highlights of the 41ST International Vienna Motor Symposium

Appendix

1. Toyota 1.5L I3 M15A-FKS and M15A-FXE Atkinson-cycle engines
   "The new 1.5 L gasoline engine from the TNGA series", H. Kitadani et al. (2020)

2. Ford EcoBoost 500 - 1.5L I3 GDI turbo engine
   "EcoBoost 500: Taking Award-Winning Technology to the Next Level", C. Weber et al. (2020)

3. Hyundai-Kia Smartstream 1.0L GDI turbo engine
   "The New Hyundai-Kia's Smartstream 1.0L Turbo GDi Engine", K. Hwang et al. (2020)

4. Mercedes M254 GDI turbo engine
   "M254 – the Mercedes-Benz 4-Cylinder Gasoline Engine of the Future", T. Schell et al. (2020)

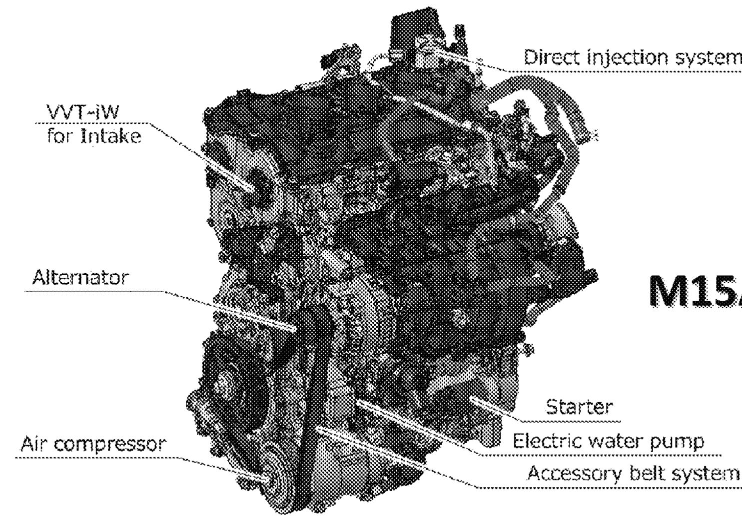
5. Mercedes-AMG M139 GDI turbo engine
   - Super Sports Cars in the Compact Class; the world's most powerful four-cylinder engine in series production, made in Affalterbach, R. Illenberger et al. (2020)

6. Light-duty diesel engines with dual-SCR dosing system
   (VW 2.0L EA288 and BMW 3.0)
   - "Volkswagen's TDI-Engines for Euro 6d – Clean Efficiency for Modern Mobility", C. Helbing et al. (2020)
   - "The technical concept of the new BMW 6-cylinder 2nd generation modular Diesel engines", F. Steinparzer et al. (2020)

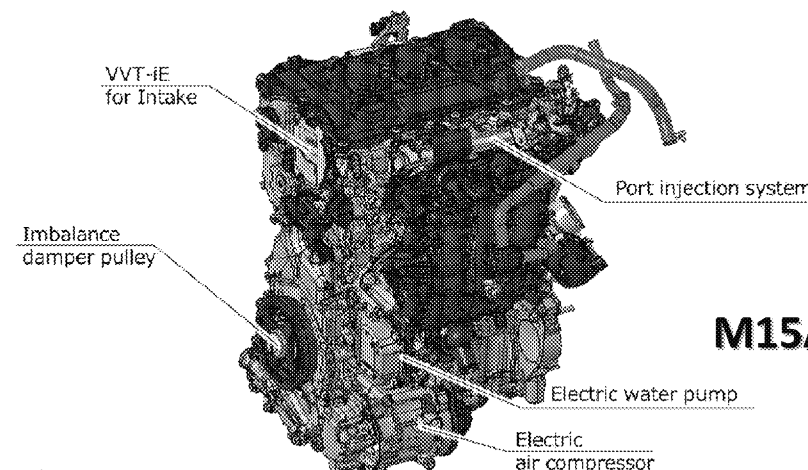
Presented to NAS-NRC
on June 16, 2020

NEW ENGINES: Toyota 1.5L I3 M15A-FKS and M15A-FXE Atkinson Cycle Engines

- 2021 Toyota Yaris and Yaris Hybrid, respectively.
- Lower cost, smaller displacement version of Toyota A20A and A25A Atkinson Cycle engines.
  - I3 maintains 500cc per cylinder of A20A engine
- Introduced in 2020 Yaris and Yaris Hybrid.
- 0W-16 (FKS) and 0W-8 (FXE) lubricants
- 14:1 geometric CR (1-pt higher than A20A)
- Does not use dual injection
  - Cost saving measure
  - FKS is GDI Atkinson
  - FXE is PFI Atkinson and HEV-only
- GPF on both versions



M15A-FKS

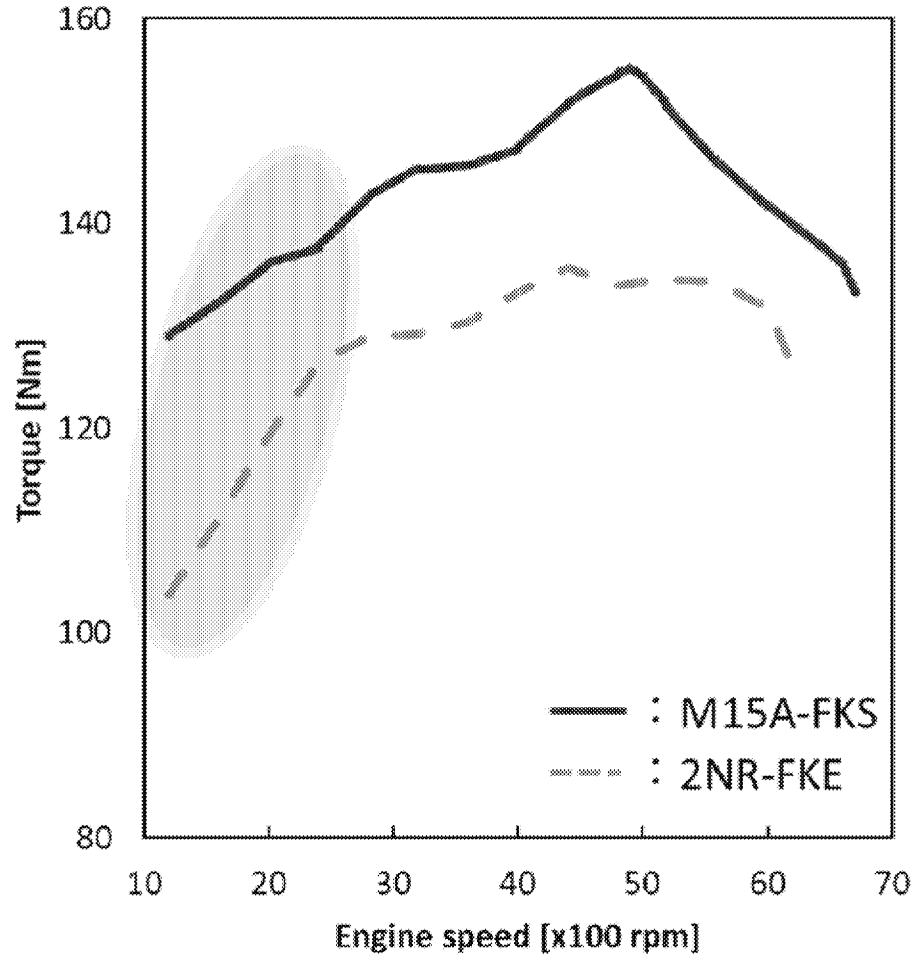


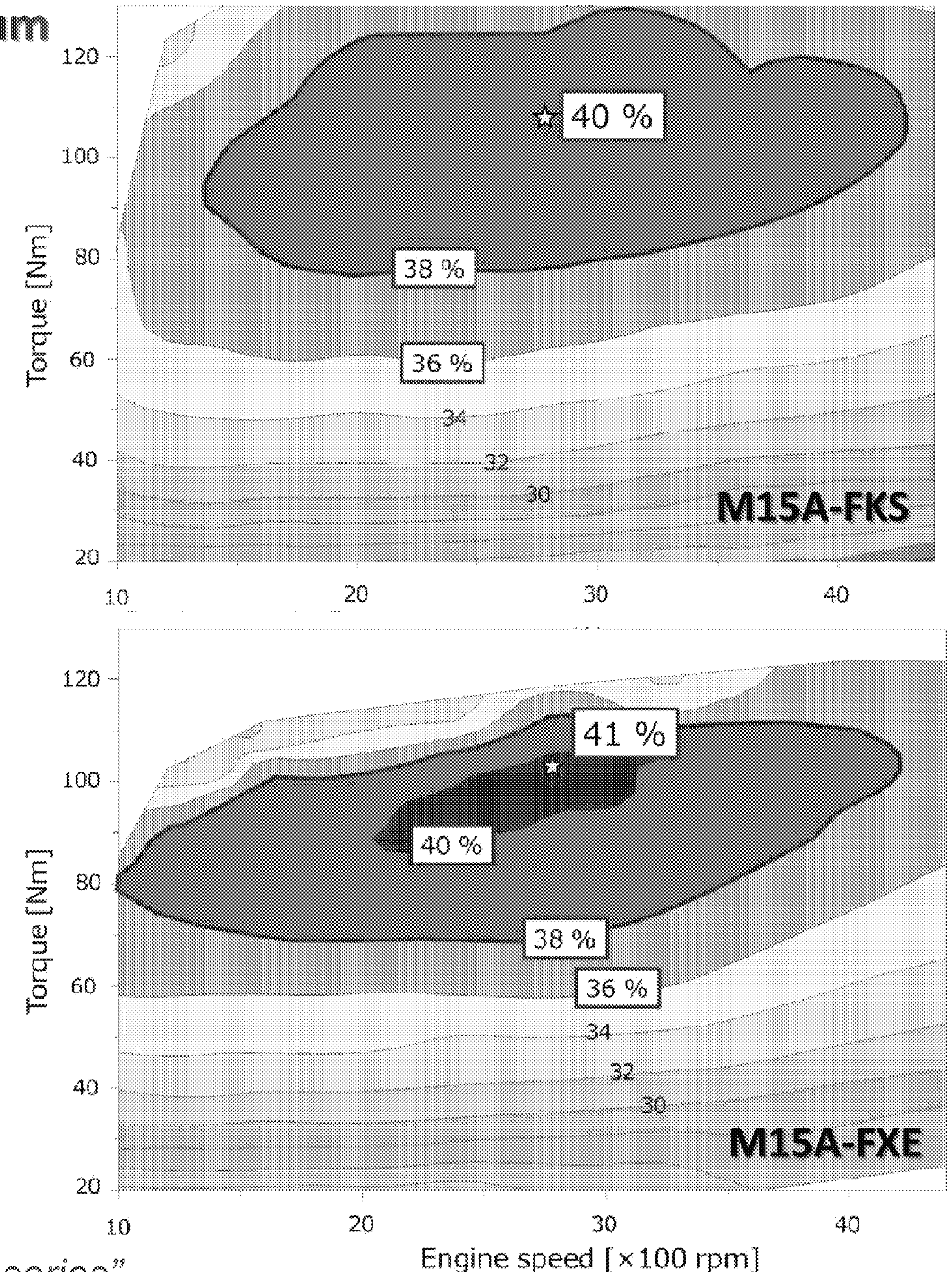
M15A-FXE

H. Kitadani et al. (2020) "The new 1.5 L gasoline engine from the TNGA series"

Toyota 1.5L I3 M15A-FKS and M15A-FXE

Note: Abbreviated torque map

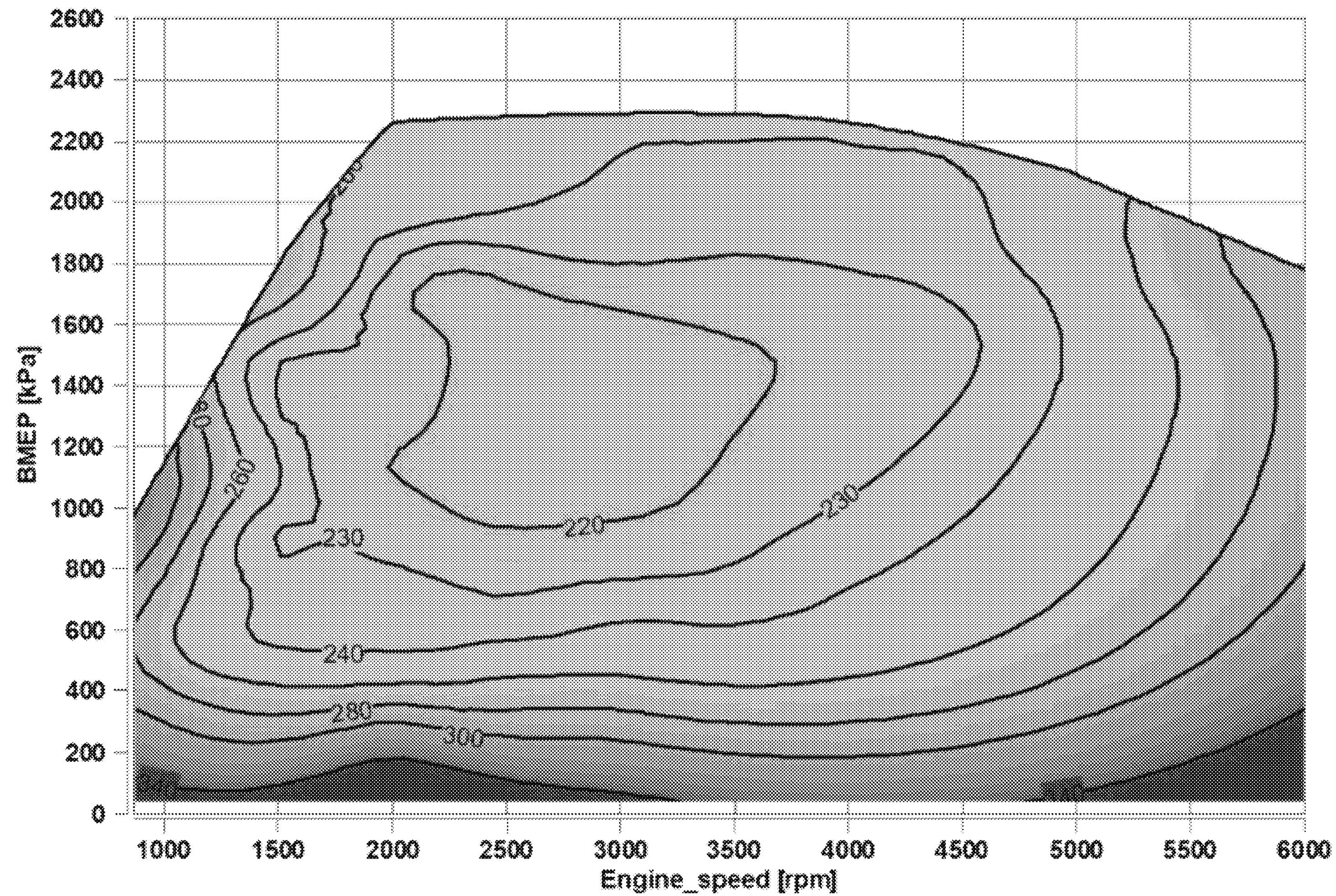




H. Kitadani et al. (2020) "The new 1.5 L gasoline engine from the TNGA series"

NEW ENGINE: Ford EcoBoost 500 1.5L I3 GDI Turbo

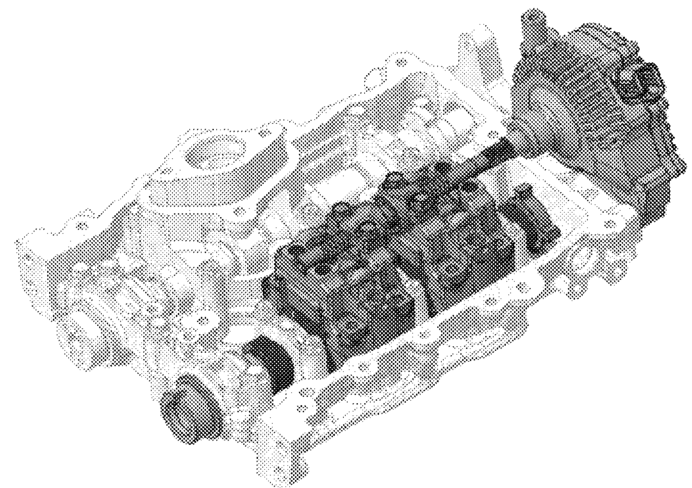
- Central injector
- Miller Cycle engine
- Schaeffler "UniAir" hydromechanical CVVL
- VGT turbocharger
- 12.5:1 geometric compression ratio
- 23 bar BMEP
    - Up to 30 bar BMEP @ 9.5:1 CR
- Large area at < 230 g/bhp-hr (~37% BTE)

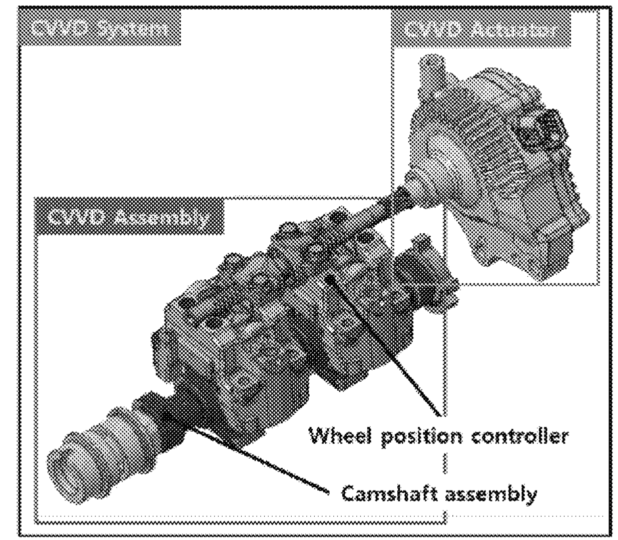


C. Weber et al. (2020) "EcoBoost 500: Taking Award-Winning Technology to the Next Level"

NEW ENGINE: Hyundai-Kia Smartstream 1.0L GDI Turbo

- Continuously variable valve duration (CVVD)
  - Intake valve duration can vary from 195 to 360 CAD
  - Can transition into and out of Atkinson/Miller operation
- 350 bar (max) direct injection
- Low-pressure cooled EGR
- Active coolant management
- Both 12V and 48V (P0) variants
- 25-bar BMEP
- Also a 1.5L I4 version

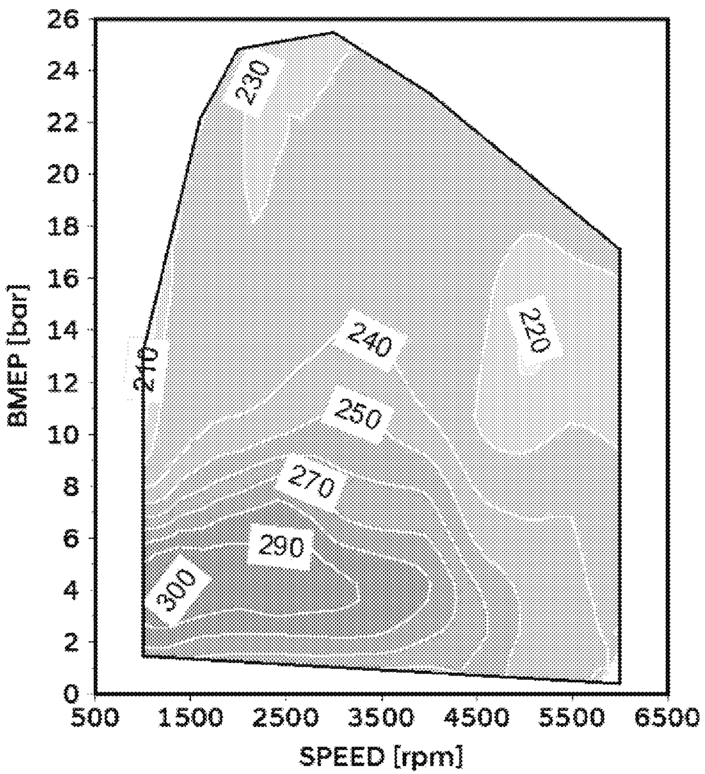




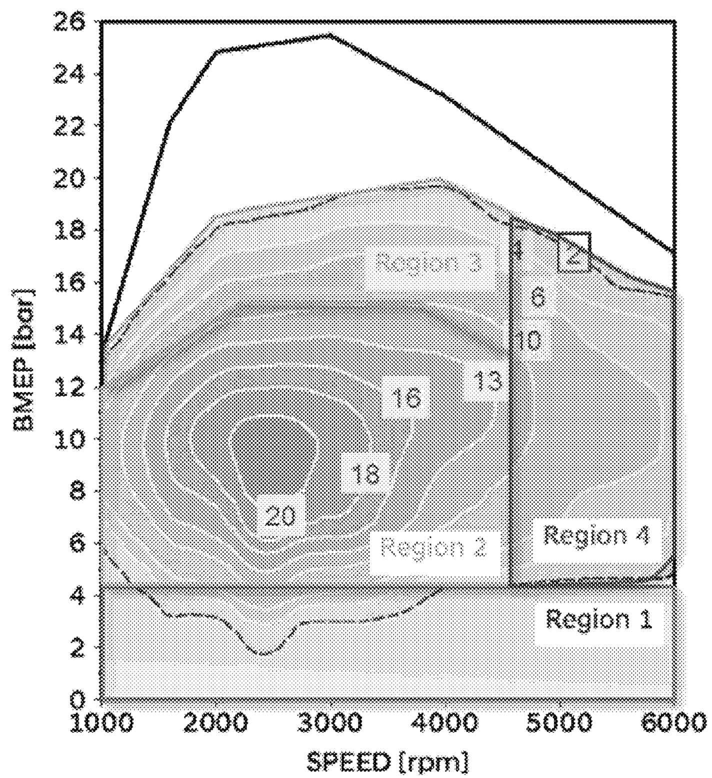
K. Hwang et al. (2020) "The New Hyundai-Kia's Smartstream 1.0L Turbo GDi Engine"

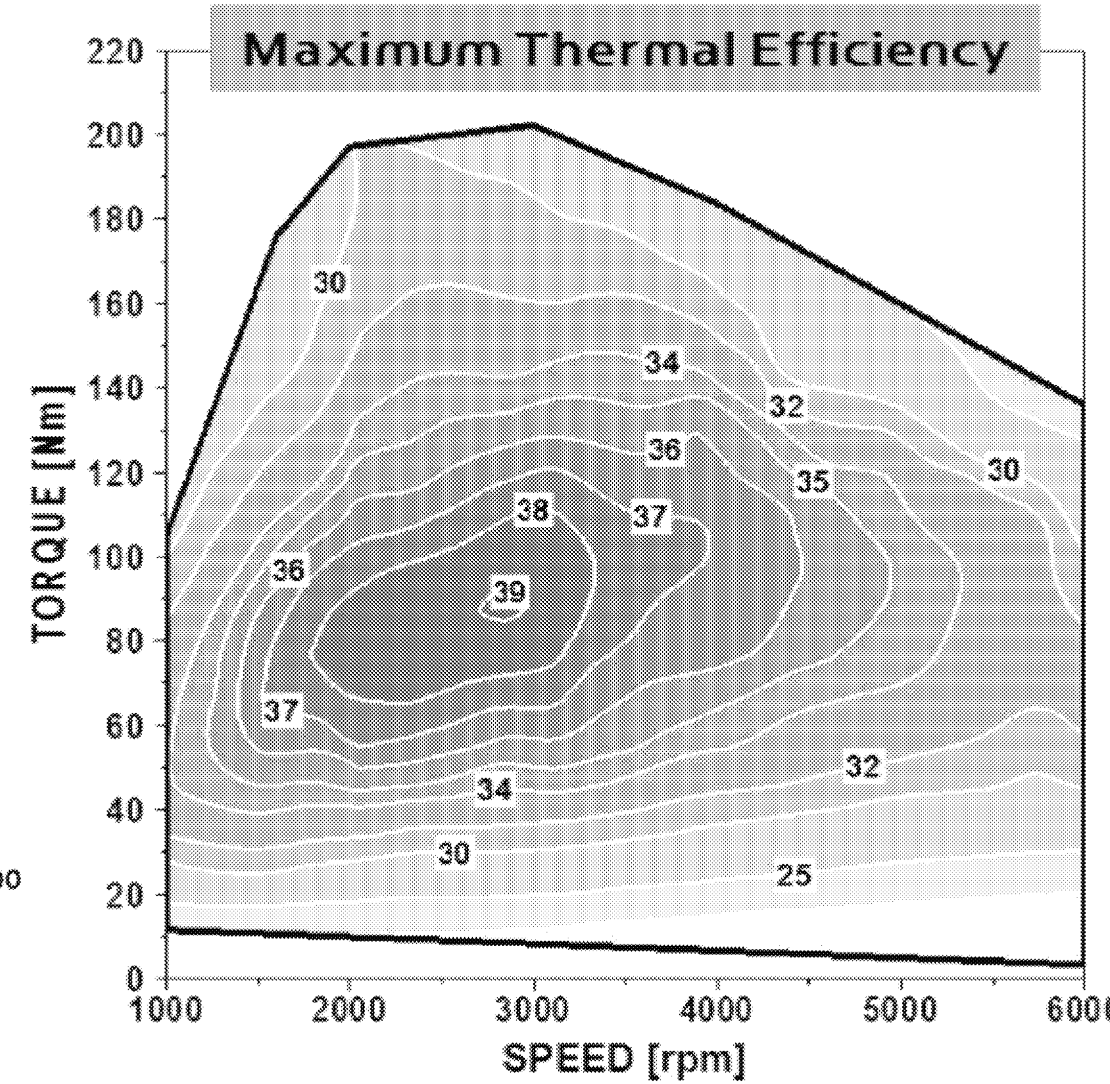
Hyundai-Kia Smartstream 1.0L GDI Turbo

Intake Valve Duration



EGR

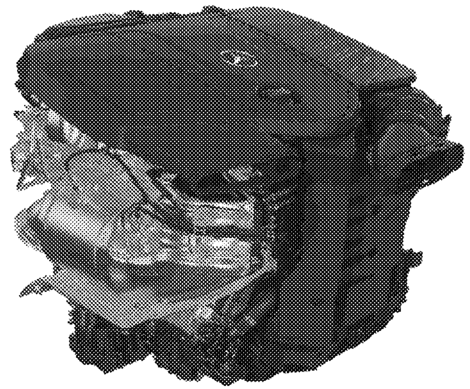


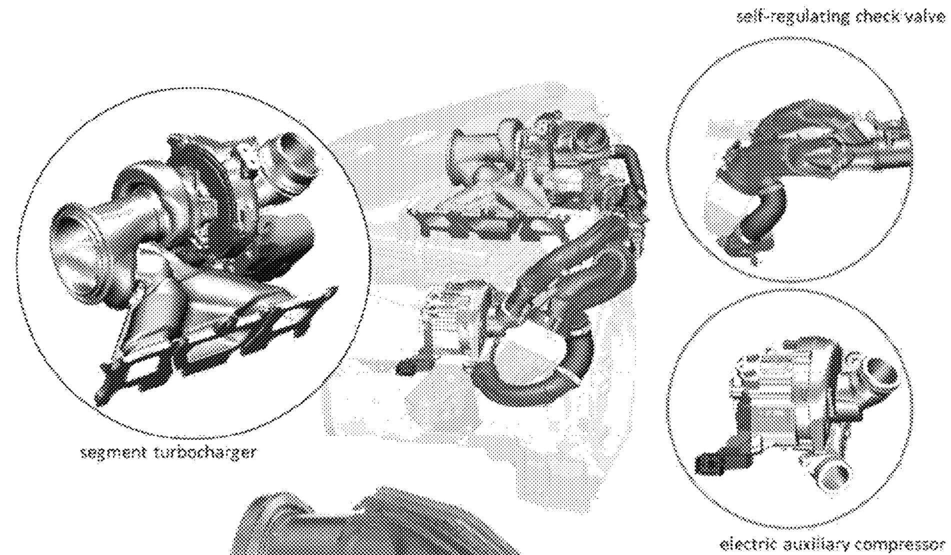


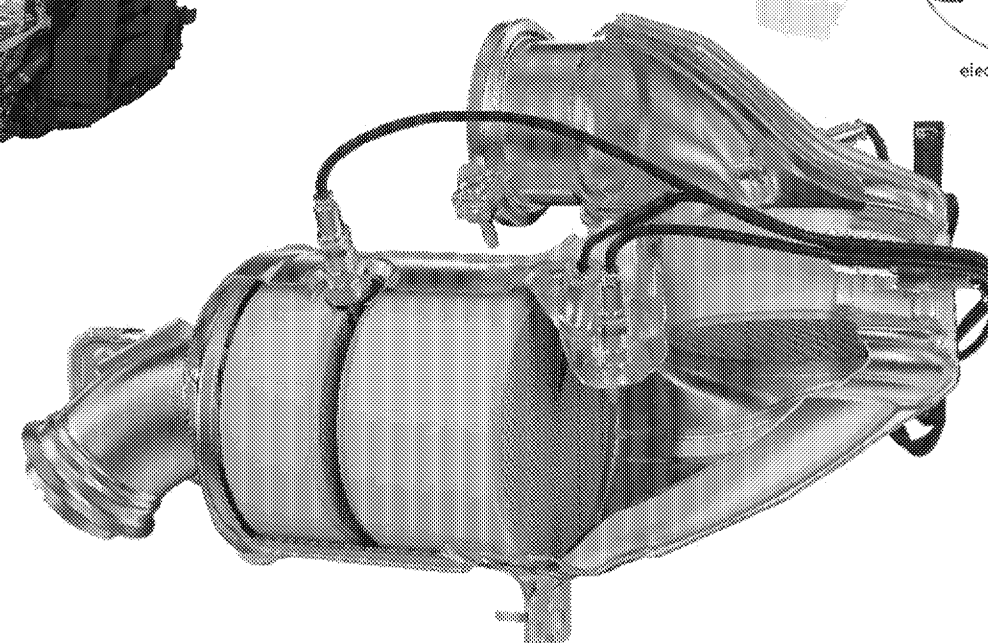
K. Hwang et al. (2020) "The New Hyundai-Kia's Smartstream 1.0L Turbo GDi Engine"

NEW ENGINE: Mercedes M254 GDI Turbo

- 2021 E-class
- 48V P1 integrated into 9-spd planetary automatic
  - 15 kW continuous
  - 180 N-m torque
- 2-stage boosting system
  - Twin-scroll turbocharger
  - 48V electric compressor
- 200 kW @ 5800 rpm
  - 100 kW/L
    - λ=1 over full range
  - 230 kw @ 6200 rpm with overboost
- 400 N-m from 1800-3000 rpm
  - 25 bar BMEP
  - 1800-4500 rpm with overboost
- Close-coupled TWC/GPF/TWC







T. Schell et al. (2020) M 254 – the Mercedes-Benz 4-Cylinder Gasoline Engine of the Future

NEW ENGINE: Mercedes-AMG M139 GDI Turbo

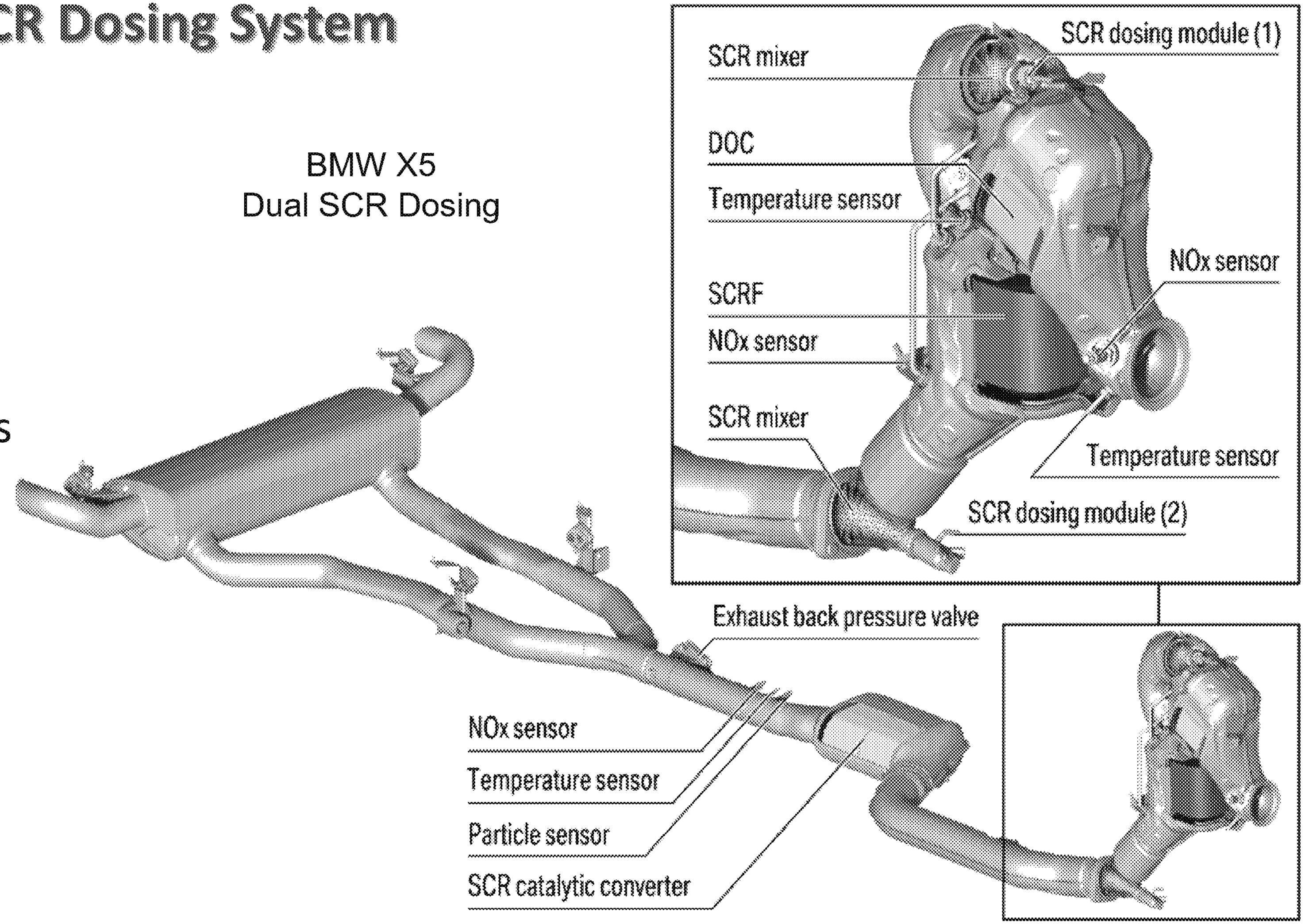
- High performance GDI Turbo
- 2.0 L I4
- 155 kW/L and 32 bar BMEP
- Dual fuel injection
- Exhaust-valve-only CVVL
- 3 cooling circuits

R. Illenberger et al. (2020) "Super Sports Cars in the Compact Class; the world's most powerful four-cylinder engine in series production, made in Affalterbach"

Light-duty Diesels with Dual-SCR Dosing System

- VW 2.0L EA288
- BMW 3.0
  - Dual VGT
  - Up to 40% EGR at light loads
  - 48-volt P0

BMW X5
Dual SCR Dosing



Note: VW and BMW have no plans to bring either engine to the U.S.

C. Helbing et al. (2020) "Volkswagen's TDI-Engines for Euro 6d – Clean Efficiency for Modern Mobility"

F. Steinparzer et al. (2020) "The technical concept of the new BMW 6-cylinder 2nd generation modular Diesel engines"

Message

From: Moran, Robin [moran.robin@epa.gov]
Sent: 7/15/2020 3:29:14 PM
To: Charmley, William [charmley.william@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Haugen, David [haugen.david@epa.gov]
CC: Olechiw, Michael [olechiw.michael@epa.gov]; Safoutin, Mike [safoutin.mike@epa.gov]; Snapp, Lisa [snapp.lisa@epa.gov]; Barba, Daniel [Barba.Daniel@epa.gov]; Moskalik, Andrew [Moskalik.Andrew@epa.gov]
Subject: For your review: Draft EV Cost Parity briefing for Sarah -- comments by 3:30 today, please
Attachments: 2020_07_16_Cost_Parity_Status_Sarah_v2_RM.pptx

Importance: High

Dear Bill, David and Karl,

Here is the draft EV Cost Parity briefing for your review. We're on with Sarah tomorrow (Thursday) at 1pm, so will need to get this OTAQ Materials by 4 today – so if you could get comments by 3:30 today that would be appreciated.

I'm sending this out on behalf of Mike S, who's giving a presentation (on EV cost parity!) at the Automotive Futures EV Tipping Points conference this morning.

Thanks in advance for your review and any comments.

Robin

Message

From: Safoutin, Mike [safoutin.mike@epa.gov]
Sent: 7/16/2020 11:59:37 AM
To: OTAQ Materials [OTAQMaterials@epa.gov]
CC: Charmley, William [charmley.william@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Haugen, David [haugen.david@epa.gov]; Moran, Robin [moran.robin@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Moskalik, Andrew [Moskalik.Andrew@epa.gov]; Snapp, Lisa [snapp.lisa@epa.gov]; Barba, Daniel [Barba.Daniel@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Jackman, Dana [jackman.dana@epa.gov]; Helfand, Gloria [helfand.gloria@epa.gov]
Subject: Briefing for Sarah on Cost Parity - 1:00 Thurs July 15
Attachments: 2020_07_16_Cost_Parity_Status_Sarah_v4_final.pptx

Hello everyone,

Attached please find the presentation for our 1:00 meeting with Sarah on EV Cost Parity. Thanks,

Mike

_____

Michael J. Safoutin, Ph.D.
Mechanical Engineer
Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
2000 Traverwood Drive, Ann Arbor, MI 48105
(734) 214-4348
Safoutin.Mike@epa.gov

Message

From: Kenausis, Kristin [Kenausis.Kristin@epa.gov]
Sent: 7/16/2020 6:54:08 PM
To: Simon, Karl [Simon.Karl@epa.gov]
CC: Snapp, Lisa [snapp.lisa@epa.gov]; Graff, Michelle [graff.michelle@epa.gov]
Subject: EV Myths + EV Charging draft web content - For your review
Attachments: EV chargers 071420.docx; Draft EV Myths 071620.docx

Hi Karl,

Per our meeting this AM, attached please fine draft web content for:

1. EV Myths (approved by you and Erin months ago, but with the battery myth added back in at the end)
2. EV Charging (approved by Erin)

We will send them to the graphics folks to finalize once we've locked down the content.

Thanks in advance for your feedback.

Kristin Kenausis
U.S. Environmental Protection Agency
Office of Transportation and Air Quality
(202) 343-9225
e-mail: kenausis.kristin@epa.gov

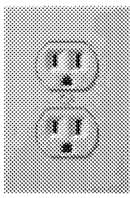
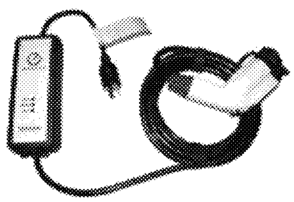
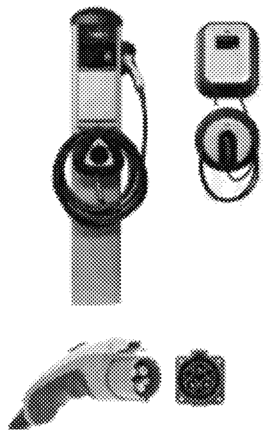
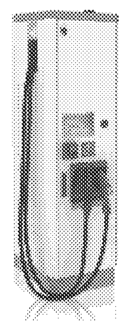
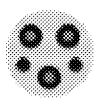
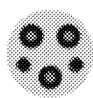
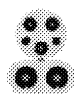
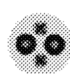
How do I charge my Plug-in Electric Vehicle?

Charging your all-electric vehicle (EV) or plug-in hybrid electric vehicle (PHEV)–together known as plug-in electric vehicles (PEVs)–is similar to charging your other electronics. One end of an electrical cord is plugged into your car, and the other end is plugged into a power source or charging equipment.

There are three categories of charging equipment based on how quickly each can recharge a car's battery. Charging times for PEVs are also affected by:

- How much the battery is depleted
- How much energy the battery can store
- The type of battery
- Temperature

Charger Fast Facts

Charging Options	**Level 1 (120v)**	**Level 2 (240v)**	**Direct-current (DC) Fast Charging**
	 		
What does the charge port on the vehicle look like?	 J1772	 J1772	 CCS  CHAdeMO  Tesla combo
How fast do they charge?	2–5 miles per 1 hour of charging	10–20 miles per 1 hour of charging	At least 60 miles per 20 minutes of charging. Charging time may be shorter depending on station power.*
Where can I find them?	• In your house/garage • Possibly at your apartment/condo and workplace	• In your house/garage (You will need additional equipment)	• At public charging stations

	• No need to install anything; most automakers provide charger cords	• Possibly at your apartment/condo and workplace • At public charging stations	• Limited availability, though becoming more common

*Higher powered DC Fast stations that charge cars more quickly are becoming available, along with vehicle models that can accept the faster charge.

[HYPERLINK "https://afdc.energy.gov/fuels/electricity_infrastructure.html"]

Does Level 1 charging look familiar? It's the same outlet you use for your cell phone and toaster! And the Level 2 outlet is the same kind of outlet you use for your dryer and other high-powered appliances. You can plug your car directly into the 120V outlet, but you will need the appropriate Electric Vehicle Supply Equipment (EVSE) to charge a PEV via the 240V outlet.

Frequent Questions about PEV Charging

Can I use any charger?

Not yet. All PEVs can use Level 1 and Level 2 (non-Tesla) chargers. DC Fast Charging, however, is vehicle-specific and not available for all PEVs. If your PEV has DC Fast charging capabilities, it has one of the three types of fast charging ports – CHAdeMO, CCS, or Tesla. Vehicles' charging ports vary by auto manufacturer, so make sure to check which connector is compatible with your vehicle before charging.

Fortunately, many DC Fast charging stations now provide multiple connector options in order to service as many EVs as possible. You can check if a specific station has your vehicle's connector in DOE's Alternative Fuel Data Center's station locator. [HYPERLINK "https://afdc.energy.gov/fuels/electricity_locations.html" \l "/find/nearest?fuel=ELEC"]

Is my PEV-charging experience similar to filling up my car at a gas station?

In some ways, yes:

- Like a hose to a gas pump, charging a PEV is plugging an electric cord into an outlet/charger.
- Like gas stations, there are public charging stations, where you pull off the road and fill up (i.e., charge).

In other ways, charging a PEV is different:

- If you have a home charging option, and typically don't travel beyond your car's range, almost all your charging can be done at home. No more gas station stops.
- Workplace charging is becoming a more common option. Rarely do you have access to a gas pump at your office.

- Fully charging your PEV at a public charging station does take longer than the usual 5-10 minutes spent filling your car at a gas station (see chart above), although you could "top up" at a public station, then finish charging when you get home.
- There are still far more gas stations than public charging stations, so vehicle charging may require a bit more planning when you hit the road with your PEV.

How do I pay to charge my PEV?

For public charging stations, payment is by credit card at the pump, by a mobile app, or a monthly subscription service. And sometimes public charging is even free! If you charge at home, the cost will be included in your monthly electric bill, just like you pay for the electricity use of home appliances.

Can I get reimbursed for installing a charger at home or at my workplace?

There may be federal, state, or utility incentives available for installing a level 2 charger. [HYPERLINK "https://afdc.energy.gov/laws/search"].

How does the cost of charging compare to gasoline?

It depends. The price of gasoline and electricity varies around the country, but it is typically cheaper to charge a PEV than to fill up a gas tank. [HYPERLINK "https://fueleconomy.gov/feg/savemoney.jsp" \h] is a great place to compare refueling costs of a plug-in electric vehicle that recharges at home with a gasoline vehicle. The calculator allows you to personalize fuel prices* and driving habits when comparing two vehicles. The results provide fuel cost comparisons by week, month, year, or over 10 years.

*Visit U.S. Energy Information Agency website to find your state's [HYPERLINK "https://www.eia.gov/electricity/state/"] (cents/kWh) and [HYPERLINK "https://www.eia.gov/petroleum/gasdiesel/"].

Message

From: Snapp, Lisa [snapp.lisa@epa.gov]
Sent: 8/6/2020 7:26:12 PM
To: Simon, Karl [Simon.Karl@epa.gov]
Subject: SAEVs team 1-pagers so far
Attachments: 2019_08_13 SAEV paper - summer conferences.docx; 2020-05 SAEV paper 9 COVID_research needs_Final.docx; 2020_04_30 SAEV paper 8 pass-mile_metric_Final.docx; 2020_03_04 SAEV paper 7 ArchetypesofPlaceandPopulation_final.docx; 2019_12_04 SAEV paper 5 TestingEVs.docx; 2019_10_02 SAEV Paper 3 sharedFleetZEVs.docx; 2020_02_06 SAEV paper 6 ConferenceHighlights_v2.docx; 2019_11_06 SAEV paper 4 TestingAVs.docx; 2019_09_04 SAEV paper 2 Guiding Principles.docx; 2020-06 SAEV paper 10 OMEGA2_Draft.docx; 2020-07_MOVES EVs.docx

Lisa Snapp

Director, Climate Analysis and Strategies Center
Transportation and Climate Division
Office of Transportation and Air Quality
US Environmental Protection Agency
734-214-4282 desk
734-545-3680 mobile
snapp.lisa@epa.gov

Mobilizing Changes in Transportation

Message

From: Simon, Karl [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=4D781D1AD595415DB3A4E768C2D2B3FC-SIMON, KARL]
Sent: 3/4/2021 2:33:06 PM
To: Mroz, Jessica [mroz.jessica@epa.gov]
Subject: slides for today
Attachments: NTAA march 2021 FoT talk.pptm

Not sure if it is helpful to send these before hand or not so if it is please distribute them. thanks

Thanks for that nice introduction. It's always a pleasure to be here with our transportation colleagues from UC Davis, who are doing such important work in identifying a sustainable transportation future.

I'm really glad that you are taking advantage of this terrible experiment we are all in, to begin to understand some fairly dramatic changes in behavior. Thanks for doing this work.

I'm going to take just a few minutes here to talk a little bit about my perspective on what this means and what we can hope to learn from it.

Disruption as a Driver of Change

"People are more likely to change their commuting behavior when they move or start a new job, or when there is a serious disruption that forces them to temporarily abandon their habits."

--Ariella Kristal and Ashley Whillans, Harvard Business School

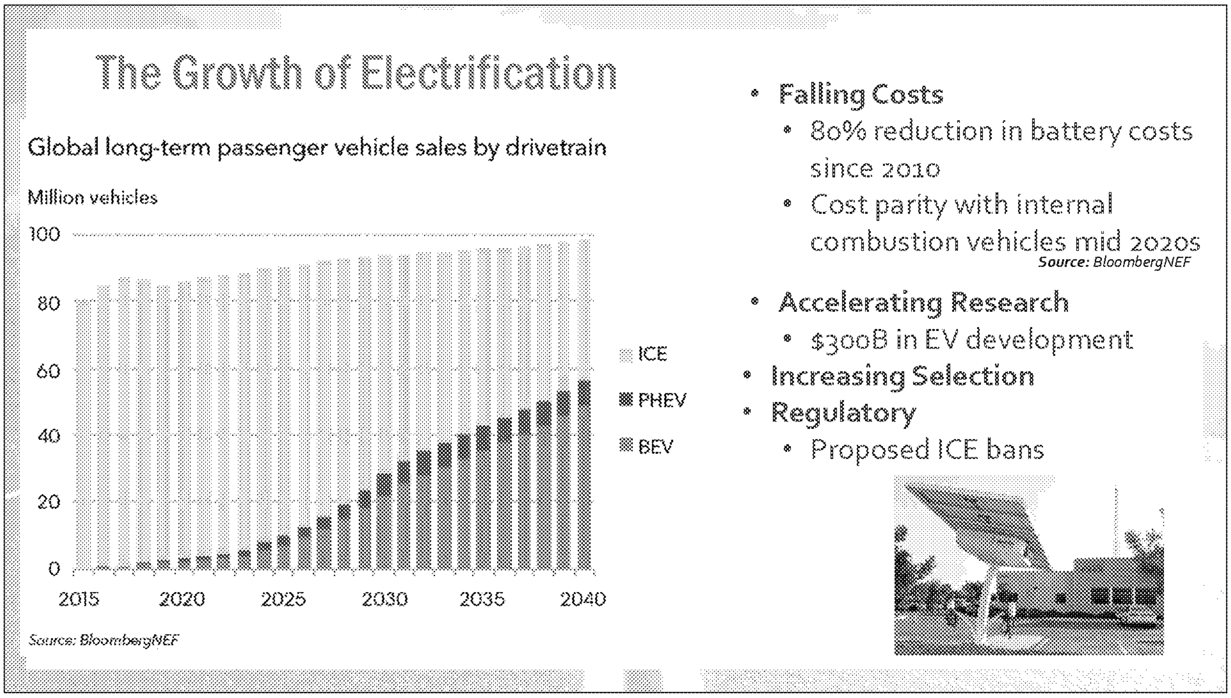
Harvard Business Review: Why It's So Hard to Change People's Commuting Behavior
https://hbr.org/2019/12/why-its-so-hard-to-change-peoples-commuting-behavior

So, linking back to Giovanni's presentation on behavior change -- I thought this quote from December's Harvard Business Review was relevant. Ariella Kristal and Ashley Whillans had done research into what it takes to change commuting behavior, trying to understand why it's so sticky, even when people say they want to change, they will change, that certain things will be influential for them – and then they don't change. And the researchers found this – that "people are more likely to change their commuting behavior when they move or start a new job, or when there is a serious disruption that forces them to temporarily abandon their habits."
Well, you can't say this isn't a serious disruption.

All of us in this field of clean and sustainable transportation have a lot of important questions about behavior change, which are really difficult to get at most of the time. We can't ask people to take transportation modes that don't exist, so we have to rely on the best research methods we have, which inevitably rely on some conjecture.

But here, against our will and with a cost that is far far too high, to be sure, we have a natural experiment that has been forced on all of us. This has given us a rare chance to take a look at the effects of those changes on the world around us.

We have an opportunity to learn here, that – hopefully – will not come again.



EV sales were up to a little more than 2% last year, and as much as 7 or 8% in California
Bloomberg new energy finance projects EV and PHEV sales to be more than half of all global sales by 2040
Why? Battery costs are down 80% in the last 10 years, and cost parity with ICE vehicles appears possible within a few years.

Manufacturers have announced at least $300 Billion in development, and EVs are all they're talking about. Expect to see many more models, and types of vehicles in the market soon. You'll even be able to buy an electric F-150 as early as 2021.

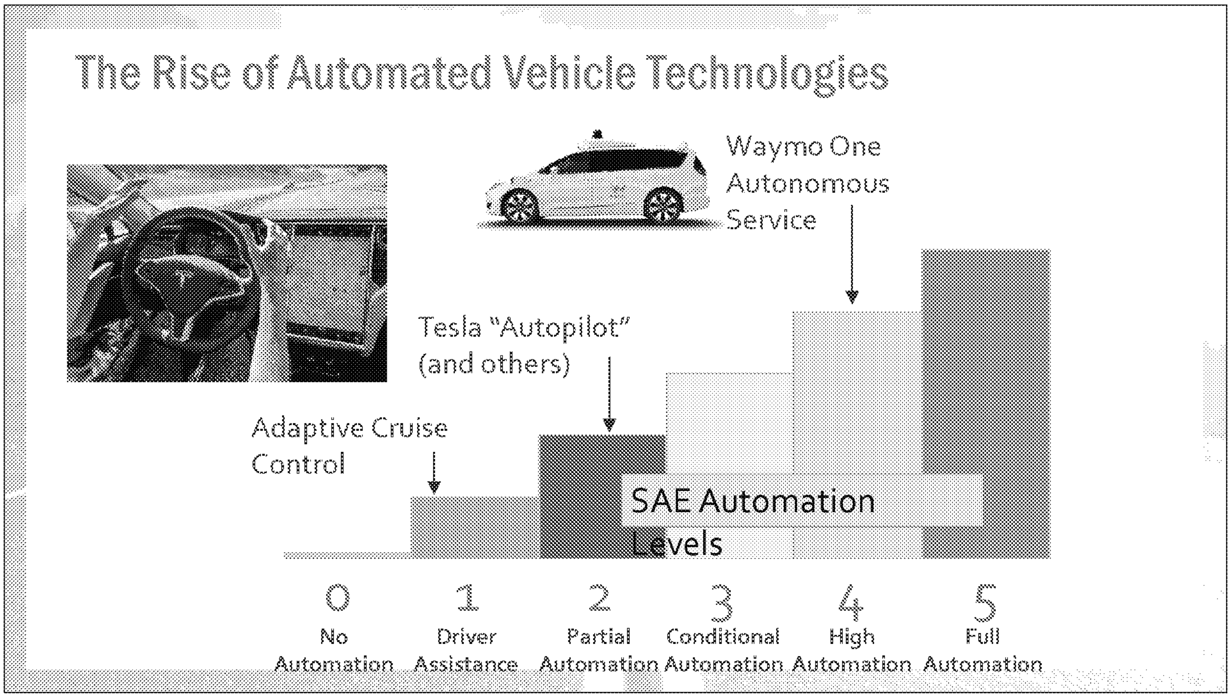
Finally, regulatory pressure. Several countries including Norway, France, UK, India, and China have announced proposed bans on ICE engines – and other EV policies.

https://about.bnef.com/electric-vehicle-outlook/
https://www.reuters.com/article/us-autoshow-detroit-electric-exclusive/exclusive-vw-china-spearhead-300-billion-global-drive-to-electrify-cars-idUSKCN1P40G6

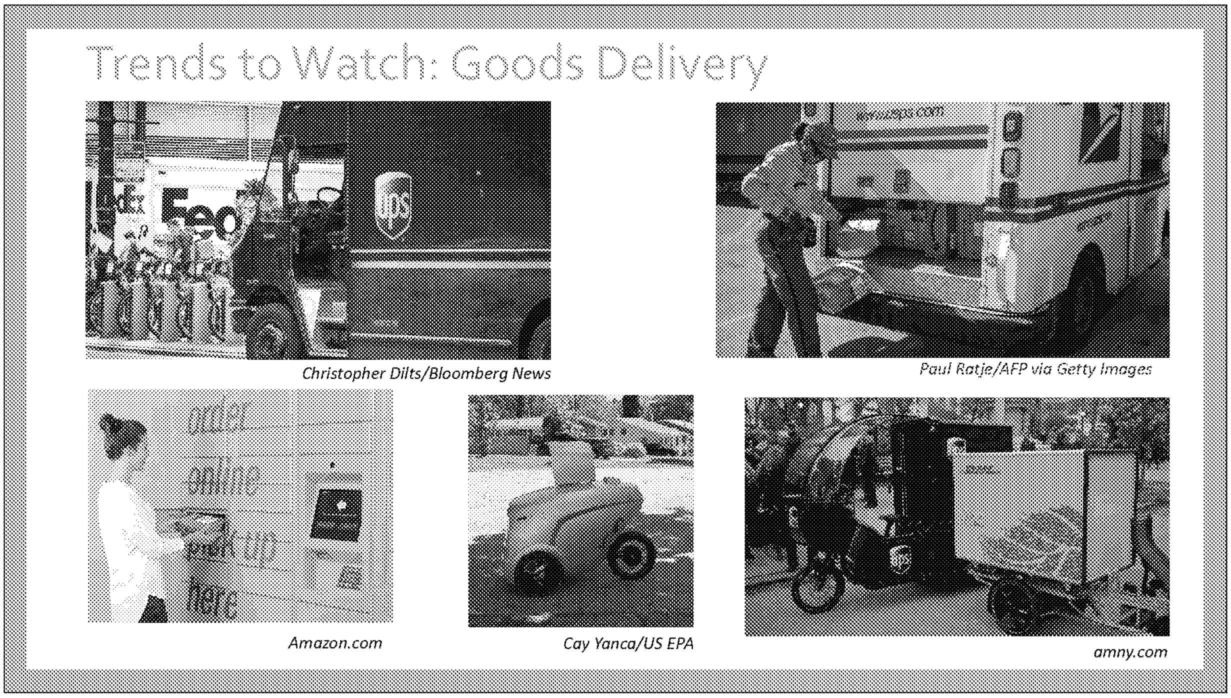
https://corporate.ford.com/articles/sustainability/new-generation-electric-vehicles.html
https://fortune.com/2017/10/02/gm-20-all-electric-vehicles-2023/

Ford: 16 EVs by 2020
GM: 20 EVs by 2023

Countries with proposed ICE bans:
Norway (2025)
India (2030)
Israel (2030)
Netherlands (2030)
France (2030)
UK (2040)
Germany (TBD)
China (TBD)



- 40,000 fatalities in the US each year
- Automated technologies don't have a direct environmental impact, but may enable very significant changes as we'll talk more about in a minute.



The other factor—moving goods—is also a big and important question. Even before the pandemic, quantifying the efficiency of goods movement was challenging, but if we want to get our hands around the full impact of emissions related to COVID, we need to understand the freight elements.

And now, the wildly swinging demand for goods, as well as the closure of borders, has caused all kinds of disruptions within the supply chain.

We know for example that ports have been seeing drops in cargo throughput since February, and some experts are predicting canceled sailings through September,

We know that total carloads of freight rail in the U.S. are down ~20% for June 2020 compared to the previous year,

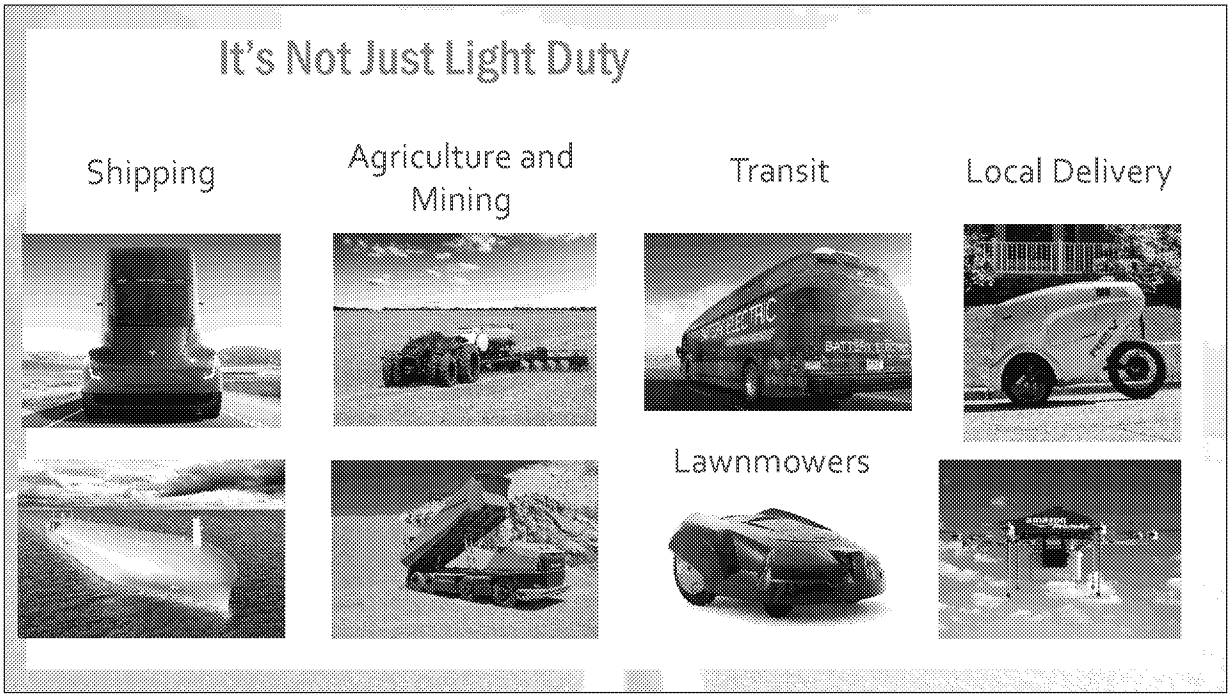
And while some trucking fleets have seen declines in freight levels, the number of longer trips (above 100 miles) has returned to—or even increased from—pre-pandemic levels.

We will have to see what this all means.

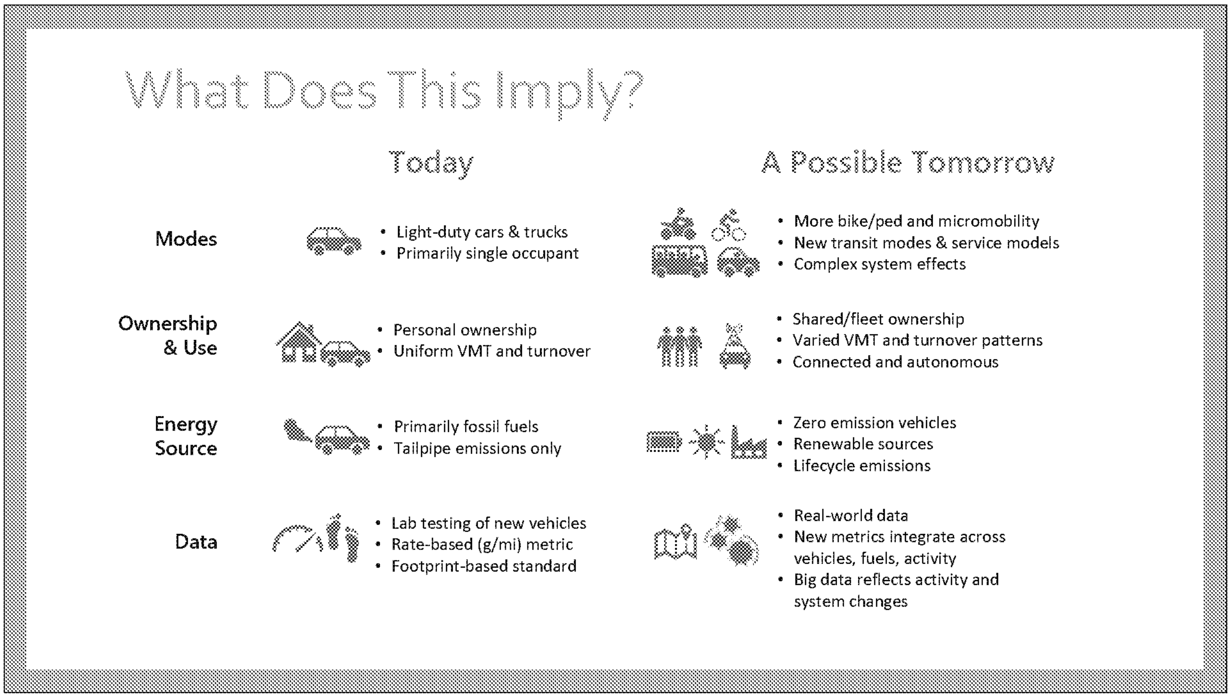
Certainly we're seeing some innovation as well:

Repurposing malls and big box stores as fulfillment centers
Taxis delivering groceries
Bicycle delivery

And let's not forget robots – the middle picture here on the bottom was taken by a colleague of mine as an order of burritos was delivered to her house. Our local newspaper says that these robots are delivering four times as many food orders in Ann Arbor as they were before this crisis. So . . . .that's a lot?!?



- Amazon ordered 100,000 electric delivery vans from Rivian

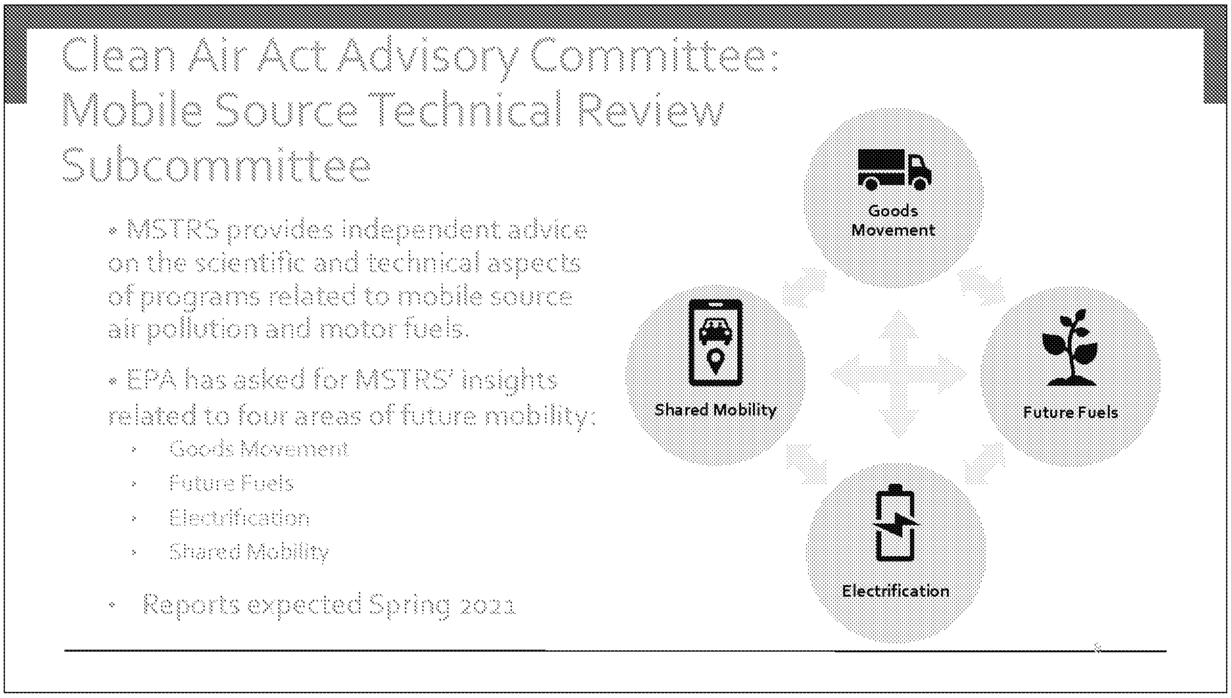


So—what does this imply?

It means we can learn a lot and apply it to our thinking moving forward.

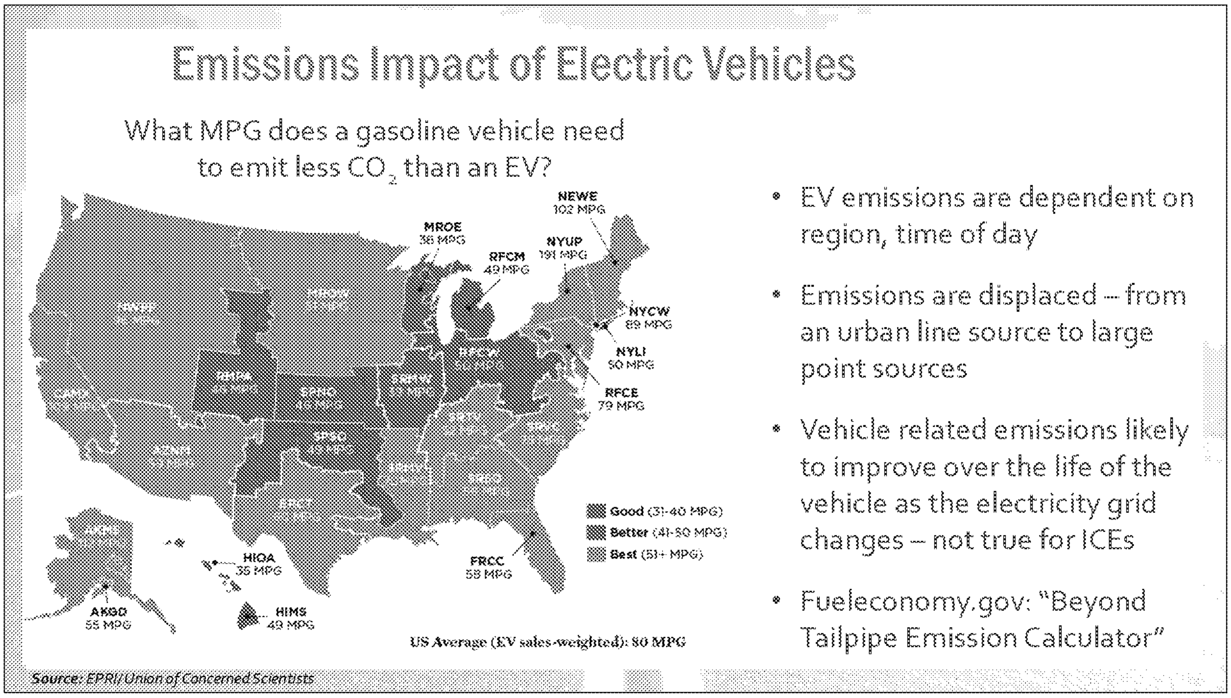
Today, we have a certain type of transportation system –primarily owner-occupied gasoline vehicles with fairly consistent vehicle miles travelled and turnover rates. The reality is that most people in this country get around by driving themselves. The regulatory structures around all of that reflect that dominant paradigm.

But we're seeing, as a result of COVID, along with other trends that were already emerging, that tomorrow could be different –with a more diverse set of mode choices as people start adopting new ways during this time of disruption. New travel patterns as teleworking evolves and perhaps as other lifestyle choices about where and how to live influence peoples mobility choices and the need for goods delivery. It seems like all of those patterns were already changing, and even more so now in the face of this pandemic. These and more will be things to keep in mind as we watch trends unfold.



~ 30 technical experts, since 1996

The Subcommittee provides the Clean Air Act Advisory Committee (CAAAC) with independent advice, counsel and recommendations on the scientific and technical aspects of programs related to mobile source air pollution and motor fuels. Through its various workgroups, the MSTRS addresses a wide range of developments, issues and research areas such as emissions modeling, air toxics, innovative and incentive based transportation policies, on-board diagnostics, heavy-duty engines and reformulated gasoline.

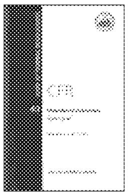


The environmental impacts of charging an EV are dependent on where, and when you charge it. It's also changing over time. This map, which is already out of date, shows the fuel economy a gasoline vehicle would need to achieve to emit less CO2 than an electric vehicle based on 2016 data.
In the pacific northwest, you'd need to get 100 miles per gallon – in a car that doesn't exist!
In the midwest, you'd need to get a much lower fuel economy since much of the regions power is based on coal.
In fact, at least one midwest trade association is promoting EVs – as a way to sell more lignite coal!
In the Carolinas, about 40% of your power is from nuclear, which doesn't turn off at night. That creates some interesting policy and pricing options to encourage people to charge at night and avoid higher emitting electricity created to keep up with peak demand during the day.

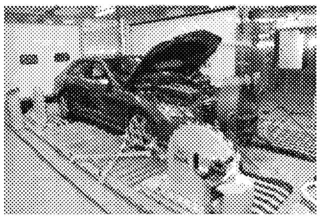
While this map is focused on CO2, the same trends exist for criteria pollutants.
EVs also displace emissions from roadways to a large point source, which will impact ambient air quality beyond simple mass reductions.

Finally, EV emissions will potentially be reduced over the life of the vehicle as the grid continues to improve. Think about it – being able to improve the emissions of your legacy fleet!

EPA OTAQ Responsibilities



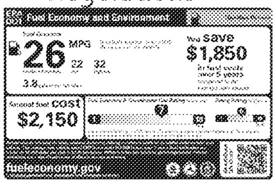
Develop and Implement Regulations



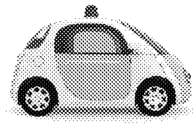
Conduct Emissions and Fuel Economy Testing

SmartWay Transport Partnership
Getting There With Cleaner Air

Coordinate Voluntary Partnerships



Provide Consumer Information



Benchmark and Evaluate Future Technology

MOVES
Motor Vehicle Emission Simulator

Develop and Support Modeling

Thanks very much for having me.

Message

From: Simon, Karl [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=4D781D1AD595415DB3A4E768C2D2B3FC-SIMON, KARL]
Sent: 8/16/2017 8:21:14 PM
To: Personal em Ex. 6 Personal Privacy (PP)
Subject: FW: Asilomar package
Attachments: Asilomar-2017-Draft-Agenda-080317.pdf; Registration List 20170807.pdf; Asilomar messages 8_11_2017.docx; Transportation policy thought starters--new mobility elevator pitch.docx; UCD-ITDP-3R-Report-FINAL_Fulton1.pdf; Honda Presentation - eVMT - Distribution.pptx; SLT--National eVMT (Draft 7.05.17).docx; WhatIf Garbage.pdf; WhatIf Groceries.pdf; SLT Thought Salon--Automated Vehs.docx; SLT Thought Salon--ZEVs.docx; SLT_The Globalization of Freight Sept 17 draft.docx; SLT Thought Salon --Light Duty Activity.docx; Thought Salon LD Tech Mar 25 2015.docx

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From: Snapp, Lisa
Sent: Tuesday, August 15, 2017 5:19 PM
To: Simon, Karl <Simon.Karl@epa.gov>
Subject: Asilomar package

Attached are materials that might be useful in preparation for Asilomar:

- Agenda
  - Session 1 Wed 9:00-12:00: Welcome
  - Session 2 Wed 1:30-3:30: Global Oil Demand
  - Session 3 Wed 4:00-6:00 Automation and Shared Mobility
  - Session 4 Thu 9:00-12:00: Electrification
  - Session 5 Thu 1:30-3:30: Freight
  - Session 6 Thu 4:00-6:00: Infrastructure Implications
  - Session 7 Fri 9:00-11:30: Policy
- Attendees list
- OTAQ messages
- OTAQ transportation policy thought starters
- UC Davis 3Rs report by Lew Fulton
- Honda's November presentation on eVMT and National ZEV
- OTAQ thoughts on eVMT
- Our What If papers exploring garbage-fueled vehicles and grocery delivery
- Finally, for extra credit, we have several of the SLT Though Salons from 2015-2016, which can be useful as reference materials:
  - Autonomous Vehicles
  - ZEVs
  - Globalization of Freight
  - Activity
  - LD Technology

Thanks,
--Lisa

Driving Innovation in Clean Transportation

Message

From: Simon, Karl [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=4D781D1AD595415DB3A4E768C2D2B3FC-SIMON, KARL]
Sent: 10/23/2017 6:27:44 PM
To: Grundler, Christopher [grundler.christopher@epa.gov]; Soth, Judith [Soth.Judith@epa.gov]; Erin Birgfeld (Birgfeld.Erin@epa.gov) [Birgfeld.Erin@epa.gov]
CC: Charmley, William [charmley.william@epa.gov]; Hula, Aaron [Hula.Aaron@epa.gov]
Subject: CALSTART info per your request
Attachments: CG CALSTART Trends info.docx

Chris,

Attached you will find my observations about CALSTART and how you might want to talk about them, my take on some people you may want to talk to or may hear from, some trends info that Aaron pulled together, and an article from our UC Davis colleagues that is useful. I believe this covers your outstanding requests but if there is other information that may be helpful let us know.

Judith – the charts are best when shown in color so if possible please print this out in color.

thanks

Driving Innovation in Clean Transportation

Message

From: Simon, Karl [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=4D781D1AD595415DB3A4E768C2D2B3FC-SIMON, KARL]
Sent: 1/12/2018 4:11:51 AM
To: Grundler, Christopher [grundler.christopher@epa.gov]
Subject: Fwd: Auto Show Primer
Attachments: 2018 NAIAS Primer.docx; ATT00001.htm

Bill is pulling together a paragraph or two at
my request that will talk about what to expect when meeting with the companies. Will send it to you when I get it. This covers the rest, including some basic info for people new to the technologies.

Begin forwarded message:

From: "Hula, Aaron" <Hula.Aaron@epa.gov>
Date: January 11, 2018 at 10:13:11 AM EST
To: "Simon, Karl" <Simon.Karl@epa.gov>
Cc: "Charmley, William" <charmley.william@epa.gov>, "Alson, Jeff" <alson.jeff@epa.gov>, "Snapp, Lisa" <snapp.lisa@epa.gov>, "Ellies, Ben" <ellies.ben@epa.gov>, "Moran, Robin" <moran.robin@epa.gov>
Subject: Auto Show Primer

Karl,

Here's what I've pulled together for Bill W. for the auto show. This has a bit more background info than previous years.

Please feel free to take a look, and if anyone has comments please get them to me today.

Thanks,

Aaron Hula
Office of Transportation and Air Quality
US Environmental Protection Agency
734.214.4267

2018 North American International Auto Show Primer

Overview

The North American International Auto Show (NAIAS, or the Detroit Auto Show) is one of the largest auto shows in the world, and certainly one of the most important. Last year over 800,000 people attended the show, including more than 5,000 journalists. There were 71 vehicle introductions and 46 new vehicles were debuted to the world. Vehicle manufacturers use the show to promote their new and existing vehicles, and to showcase advanced technology offerings. Some manufacturers will show concept cars to gauge ideas for a future design direction for the brand, or simply to explore an outlandish design idea. While the true concept cars have been rarer in recent years, they always draw some of the most press and interest from the public. This year's NAIAS is likely to focus on pickup trucks, SUVs, automated technology, and electrification.

Pickup trucks have remained about 10-15% of the market for the last decade. The market is dominated by the Ford F-150, the Chevy Silverado, and the Ram 1500. These three vehicles are the best selling vehicles in the U.S. and highly profitable for their respective companies. With Chevy and Ram introducing redesigned versions, and Ford bringing back the Ranger truck, expect this year's NAIAS to heavily emphasize pickup trucks.

SUVs accounted for a record 41% of vehicles sold in MY 2016 and the NAIAS will undoubtedly reflect the growing popularity of SUVs with offerings from nearly every manufacturer on display. SUV fuel economy has been increasing with SUV popularity so it is likely fuel economy will be prominently advertised.

Automated vehicle technology will be front and center in many manufacturer's displays. This will include features like adaptive cruise control, lane departure assist, "supercruise", and automated parking. All of these technologies are building blocks for fully autonomous vehicles and it is likely that at least some manufacturers will bring an autonomous prototype vehicle.

The **Consumer Electronics Show** (January 9-12 in Las Vegas) precedes the NAIAS and has become another very important event for the automotive industry. This year at CES, about 25% of the massive show ("about half the size of the Vatican") will be automotive, and everything from artificial intelligence, infotainment, and autonomous technologies will be on display. Ford CEO Jim Hackett is a headline speaker and autonomous vehicles will be providing transportation around Las Vegas. Partly in response to the popularity of the Consumer Electronics Show, NAIAS added the **AUTOMOBILI-D** exposition, which showcases the "rapidly evolving global automotive and mobility landscape" and will bring together many advanced part suppliers, sensor manufacturers, and automotive companies.

Electrification (from fully electric vehicles to electrified accessory loads) will probably not be front and center at NAIAS, but it will likely be part of the show. Given some of the very bullish comments from automakers (i.e. 'The future is all electric" from GM) and potential bans on gasoline and diesel cars altogether (China), it will be very interesting to see what manufacturers will present.

Schedule

January 13 – **The Gallery** is an exclusive showing from premium manufacturers, including Aston Martin, Bentley, Ferrari, Lamborghini, Porsche, and Rolls Royce.

January 14 to 21 - **AUTOMOBILI-D** is an exposition focused on the rapidly evolving global automotive and mobility landscape including autonomous technologies, connected vehicles, ride hailing, and other technology developments.

January 14 to 16 – **Press Preview**. This is when most of the big unveilings take place. Last year more than 5,000 journalists from 60 countries witnessed 71 vehicle introductions, including 46 worldwide debuts.

January 17 to 18 – **Industry Preview**. The NAIAS is open to automotive professionals before it opens to the public.

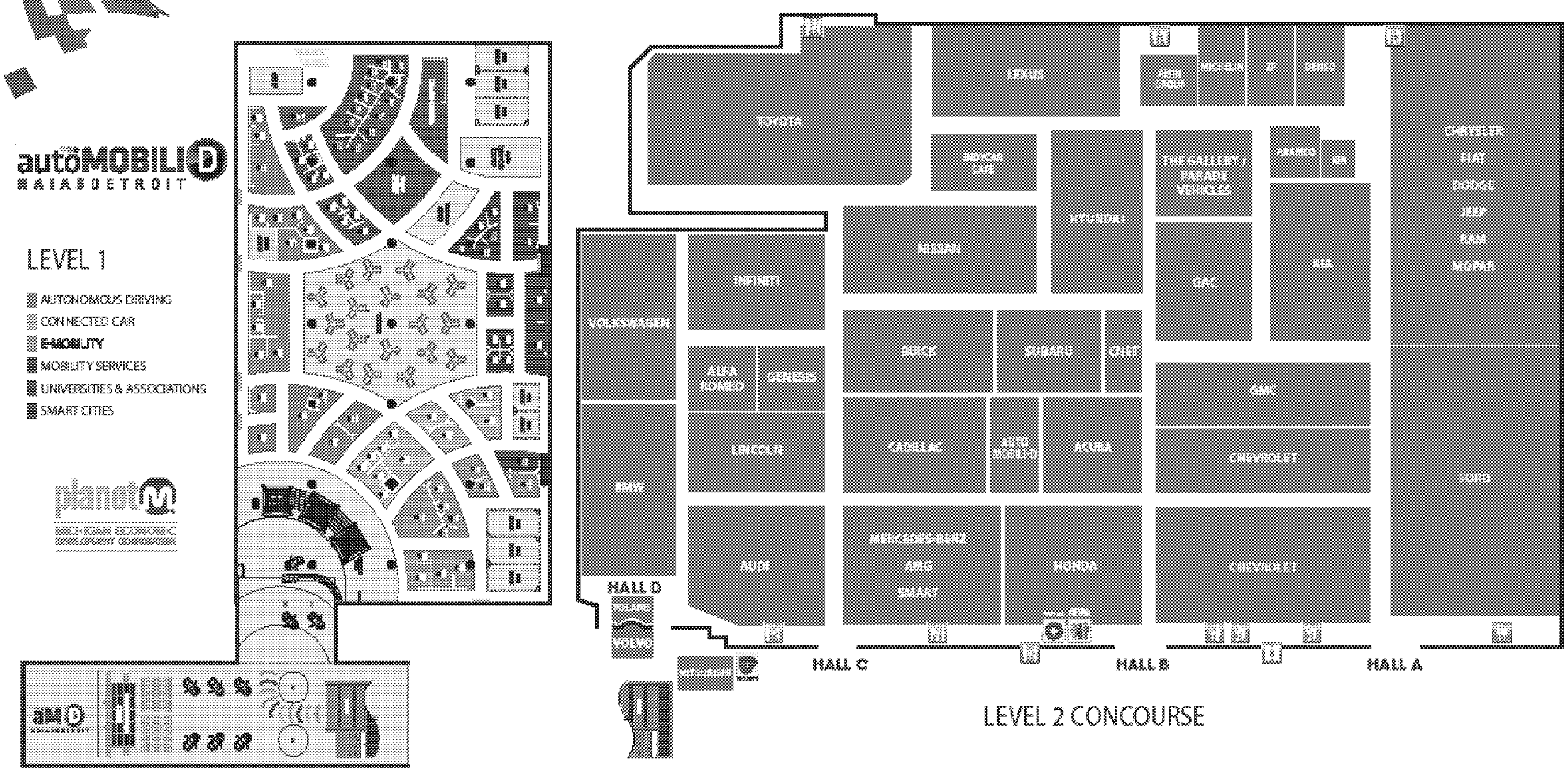
January 19 – **Charity Preview.** Probably Detroit's biggest black-tie affair of the year.

January 20 to 28 – **Public Show.** Over 800,000 people attended NAIAS in 2017.

2 0 1 8

AUTOMOBILI-D / PUBLIC SHOW FLOOR PLAN

NORTH AMERICAN INTERNATIONAL AUTO SHOW.



AUTOMOBILI-D: Saturday, January 20 – Sunday, January 21

PUBLIC SHOW: Saturday, January 20 – Sunday, January 28

Floorplan as 12-19-17

Key Technology Definitions and Terms

GDI – Gasoline Direct Injection is an engine technology where gasoline is sprayed directly into the cylinder. About 50% of new vehicles feature GDI, and this is increasing quickly.

Turbo – Turbocharged engines are often paired with GDI to allow for a "turbo-downsized" engine that can take advantage of the efficiency of a smaller engine, but the power of a larger engine when needed.

Cylinder Deactivation – Engines with cylinder deactivation can stop fuel flow to individual cylinders, allowing a larger engine to act like a smaller engine when full power is not required (for example an 8-cylinder engine could shut off 2 cylinders to act like a more efficient 6-cylinder engine during highway cruising)

Non-Hybrid Stop/Start – Many engines can turn off when a vehicle is at a stop or coasting and seamlessly turn back on as soon as pressure is applied to the gas pedal. This reduces fuel used during idling.

CVT – Continuous Variable Transmissions use a pulley system that does not rely on discrete gears, allowing for an infinite number of gear ratios for smoother accelerations and optimized operation at any vehicle speed. Almost 25% of new vehicles will feature CVTs.

7+ speed transmission – Transmissions with more speeds allow for more flexibility when optimizing how a vehicle shifts gears, and can result in significant fuel savings. About 25% of all new vehicles feature transmissions with 7 or more speed automatic transmissions.

Regenerative braking – Braking systems found on hybrid and electric vehicles where the resistance from an electric generator is used to slow a vehicle, creating electricity that can be stored and reused in the process.

Mild hybrids – Mild hybrid vehicles generally have limited hybrid capabilities, but can take advantage of some regenerative braking, have an electric motor that may provide some assistance to the gasoline engine, and can turn off the engine during idle or coasting. Mild hybrids cannot drive in an electric only mode.

Full hybrids – Full hybrids are vehicles that have a larger battery and more powerful electric motor, working in conjunction with a smaller gasoline engine. Most full hybrids, such as the Toyota Prius, can operate limited distances on electricity only.

PHEVs – Plug-in Hybrid Vehicles are vehicles that can operate on electricity stored in a battery or on gasoline. PHEVs can be plugged in and charged with electricity from an outlet or vehicle charger.

EVs – Electric Vehicles, such as the Tesla Model S and Chevy Bolt.

Utility Factor – All PHEVs have a utility factor that defines how much of the time an average driver will drive using primarily electricity.

FCVs – Fuel Cell Vehicles, which generally operate on hydrogen fuel.

AVs – Autonomous vehicles. Many additional acronyms are used for the combination of autonomous, connected, shared, and electric vehicles.

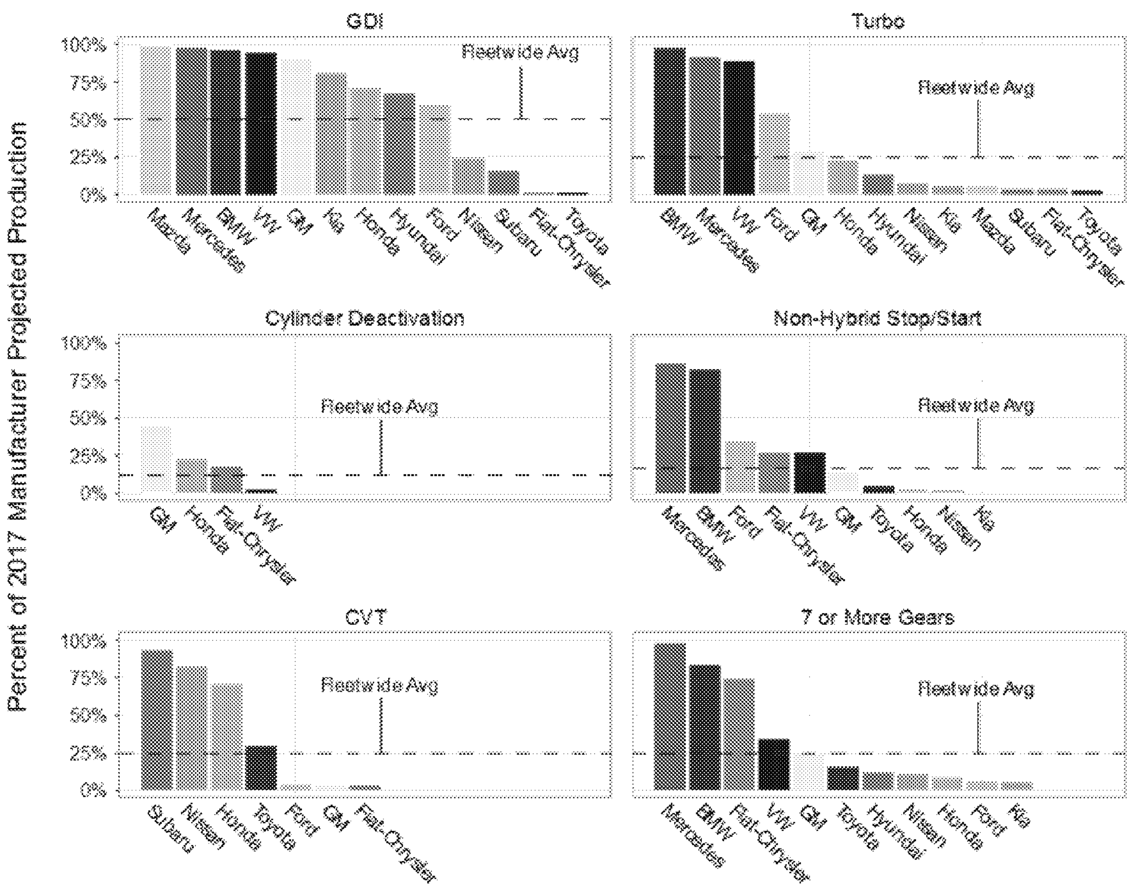
Key Industry Facts

- Vehicle sales were down 1.8% in 2017, after 7 years of increasing sales and record annual sales. 2017 was still one of the best sales years on record for the industry.

- Average new vehicle fuel economy for MY 2016 vehicles is at a record high of 24.7 mpg. Since model year 2004, fuel economy has increased 28% and in 10 of 12 years.

Automaker	2017	2016	Percent Change
General Motors	3,002,237	3,042,775	-1.3%
Ford	2,575,200	2,599,211	-0.9%
Toyota	2,434,515	2,449,630	-0.6%
Fiat Chrysler	2,073,073	2,256,849	-8.1%
Honda	1,641,429	1,637,942	0.2%
Nissan	1,593,464	1,564,423	1.9%
Hyundai-Kia	1,275,223	1,422,603	-10.4%
Subaru	647,956	615,132	5.3%
Volkswagen	625,068	591,063	5.8%
Mercedes-Benz	375,311	380,752	-1.4%
BMW	354,110	366,493	-3.4%
Mazda	289,470	297,773	-2.8%
Total	**17,245,872**	**17,553,429**	**-1.8%**

- Manufacturers are utilizing a wide variety of technologies to improve the fuel economy and performance of their vehicles. Different manufacturers are focusing on different technologies based on their vehicles and specific goals.



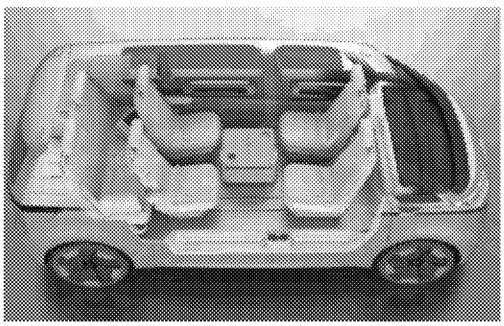
Autonomous Technology Background

Autonomous vehicles and automated vehicle technology are featured at the **Consumer Electronics Show** this year. Lyft will be providing autonomous vehicle rides between CES and the major hotels in Las Vegas. Alphabet's Waymo will be providing autonomous rides to the public using its shuttle service in Phoenix. The conversation for many manufacturers and suppliers is how to deploy and profit from the technology in the near future.

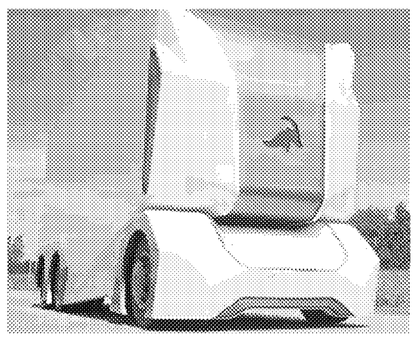
Vehicles that are on the road today already employ a wide variety of automated technologies. To capture the spectrum of technology from no automation to fully autonomous vehicles, the industry refers to the SAE levels of automation. The figure below is a simplified version of the definitions:

SAE Level	Name	Steering and Acceleration/ Deceleration	Monitoring of Driving Environment	Fallback Performance	All Driving modes
0	No Automation				
1	Driver Assistance		**Human Driver**		
2	Partial Automation				
3	Conditional Automation				
4	High Automation				
5	Full Automation		**Vehicle**		

At NAIAS this year, manufacturers will certainly be highlighting level 1 and level 2 automation technology that is going into cars being sold today. This includes options like lane keep assist, assisted cruise control, and automated parking. Some systems, such as Tesla's autopilot, Cadillac's Supercruise, and offerings from BMW, Mercedes, and Volvo are at least approaching level 3 automation. There will probably be some level 4/5 prototypes at NAIAS, but none are commercially available yet.



Volkswagen last year unveiled an electric, autonomous VW Bus concept that explored how an autonomous vehicle might be designed with a highly flexible interior. It was one of the most interesting vehicles of NAIS 2017 and it is highly likely another manufacturer will show a re-invented autonomous vehicle this year.



One other interesting autonomous vehicle unveiling that is expected at NAIAS this year is the T-Pod autonomous delivery vehicle (at **AUTOMOBILI-D**). Between the Consumer Electronics Show and AUTOMOBILI-D, there will probably be a wide range of automated passenger vehicles, transport vehicles, cargo vehicles, and drones.

Manufacturer Highlights

The following pages are a summary of the major vehicle launches expected at the 2018 NAIAS. This is based on press reports and rumors, and will not be a complete list. The manufacturers below are the 13 highest selling manufacturers (production of at least 150,000 vehicles) in the U.S. for model year 2016.

BMW (BMW, Mini, Rolls Royce)

Nearly all BMW vehicles now feature downsized turbocharged engines, most with 7+ speed transmissions and start/stop technology. BMW has stated publicly that they will offer 25 electrified vehicles, including 12 EVs by 2025.

2019 BMW i8 and i3

BMW will show the new i8 coupe and roadster editions of their plug-in hybrid supercar. They will also show an updated version of the electric i3

2018 BMW X2

BMW will also show the X2 small crossover vehicle that it will be bringing to the US in 2018.

Fiat Chrysler Automobiles (Chrysler, Dodge, Jeep, Ram, Fiat, Alfa-Romeo, Maserati)

FCA stock is up more than 20% in 2018 on rumors of a merger or purchase by Hyundai. FCA CEO Sergio Marchionne has long been looking for a corporate partner. News about this would be unexpected, but would be big headlines at the show if anything is announced.

2019 Jeep Cherokee

FCA will show the redesigned Jeep Cherokee. Jeep says it'll show more fuel-efficient engines for the Cherokee.

2019 Ram 1500

The redesigned Ram pickup truck should be stiffer, stronger, safer, and more efficient truck designed to go head-to-head with the Ford F-150 and new designs from General Motors.

Ford Motor Company (Ford, Lincoln)

2019 Ford Ranger and 2020 Ford Bronco

Ford is bringing back two iconic nameplates in the 2019 Ranger and 2020 Bronco. The 2019 Ranger will be based on the Ranger sold worldwide, which is a larger truck than the Ranger previously sold in the U.S. market. The Bronco will be released in 2020 as a competitor for the Jeep wrangler.

2018 Ford F-150

The F-150 has been the bestselling vehicle in the US for the last 35 years. The 2018 edition retains the heavy use of aluminum to save weight and a 10 speed transmission and is the first pickup to offer adaptive cruise control, blind spot monitoring, and lane-keep assist. Two new engines, a 3.3L and a 3.0L diesel, and possibly the hybrid variant might be shown at NAIAS.

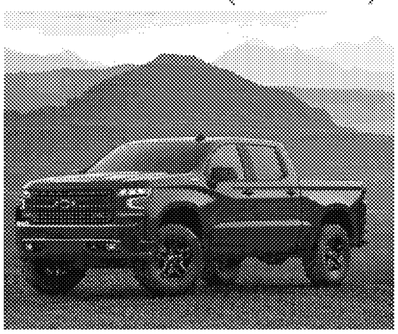
Mustang Bullitt GT

Ford will unveil the special edition mustang for the 50th anniversary of the Steve McQueen movie.

Autonomous vehicles

At CES Ford unveiled a new self-driving platform and "Transportation Mobility Cloud" intended to create a fleet of autonomous vehicles for partners from Lyft to Domino's Pizza. Ford may display something along these lines at NAIAS.

General Motors (Chevrolet, Cadillac, Buick, GMC)



2019 Chevrolet Silverado

The Chevy Silverado was the second bestselling vehicle in the US in 2017. The new version will be lighter than previous versions by using different aluminum and steel materials in higher-grade alloy, high-strength steel, and others. GM may introduce a carbon-fiber or carbon-fiber reinforced bed option for further weight savings. A 10-speed transmission will be available.

Mid-Engine Corvette

A mid-engine corvette supercar has long been rumored. GM is at least testing prototypes and could bring a version to the 2018 auto show. If this vehicle surfaces, it will be the biggest news at NAIAS.

Chevrolet Volt/Bolt

The Chevrolet Bolt has been increasing sales month by month as production has ramped up this year. GM has publicly stated they will have at least 20 EV models by 2023, and Mark Reuss, President of GM, has said "GM believes the future is all electric." Given GM's heavy investment in electric vehicles, autonomous technology, and car sharing it will be interesting to see what they announce or display at the auto show.

Honda Motor Company (Honda, Acura)

2019 Honda Insight prototype

The first hybrid to go on sale in the U.S. was the Honda Insight, a teardrop-shaped 2-seater that could easily get more than 60 mpg. Honda will show an updated version of the Insight planned for 2019.

Hyundai (Hyundai, Genesis)

Hyundai had the largest increase in fuel economy of any of the 13 largest manufacturers in the U.S. market for model year 2016, at 1.3 mpg.

Hyundai will show the **2019 Hyundai Veloster** sports coupe and the **2018 Kona**, which is a new small SUV.

Kia

Kia is showing a new Niro at the consumer electronics show, along with plans for electric and autonomous versions, and a new HMI (human machine interface) including Google Assistant.

Mazda

Mazda maintained their status as the most fuel efficient manufacturer (among the 13 largest) in MY 2016, at 29.6 mpg. Mazda will likely promote their SkyActive engines, including new turbocharged variants.

Mercedes Benz (Mercedes, Smart, Maybach)

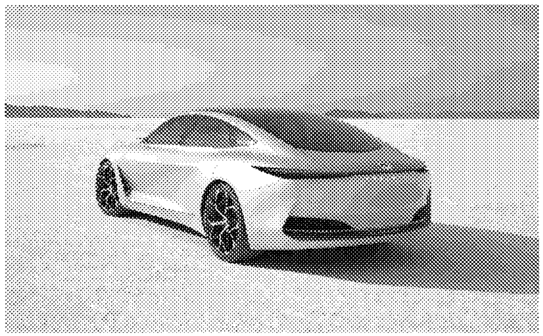
G-class SUV

Mercedes will show a new version of their high end G-class SUV. It is rumored to be more fuel efficient with a possible mild hybrid powertrain. Expect the exterior to maintain its boxy proportions.

2019 Mercedes-AMG CLS53

The other likely Mercedes reveal is a performance oriented (AMG) sedan. Rumor is that these will be hybrid electric turbocharged 6 cylinder engines.

Nissan (Nissan, Infiniti)



Nissan will likely advertise that they are the most fuel-efficient “full line” manufacturer according to EPA. Nissan’s definition of “full line” includes manufacturers selling full size trucks (this is a Nissan term, not an EPA definition). It’s not clear what Nissan will show, except for an **Infiniti concept car** that will show design ideas for future Infiniti vehicles.

Subaru

No news on what Subaru might bring to NAIAS.

Toyota (Toyota, Lexus)

Toyota will show the **2019 Toyota Avalon**, which is a large sedan. Toyota is also expected to unveil their **Lexus LF-1 Limited** flagship crossover that “redefines the boundaries of luxury.”

Volkswagen (VW, Audi, Porsche, Lamborghini, Bentley, Bugatti)

2019 VW Jetta

VW’s top-selling U.S. model will make its world debut at the North American International Auto Show in Detroit. A new 1.4L turbo engine is expected, with a 6 or 8 speed transmission. Pre-collision braking, blind spot monitoring, rear parking assist, and adaptive cruise will likely be offered.

Electric Vehicles

VW has publicly made some very aggressive statements about electrification, and may show a new electric vehicle or concept at the auto show. Chief Executive Officer Matthias Mueller announced sweeping plans to build electric versions of all 300 models in the 12-brand group’s lineup, vowing to spend $24 billion by 2030 to roll out the cars and another $60 billion to buy the batteries needed to power the vehicles.

Message

From: Ellies, Ben [ellies.ben@epa.gov]
Sent: 6/15/2017 2:15:01 PM
To: Simon, Karl [Simon.Karl@epa.gov]
Subject: RE: Registration Reminder: Asilomar Conference Aug. 22-25, 2017
Attachments: Autonomous Vehicle Brown Bag - Ellies 061417.pptx

Here you go. FYI the notes pages include a little more context since I am not there to talk to it ☺

A couple of embedded videos worth clicking on in the actual slides as well.

Thanks,
Ben

From: Simon, Karl
Sent: Thursday, June 15, 2017 9:30 AM
To: Ellies, Ben <ellies.ben@epa.gov>
Subject: Re: Registration Reminder: Asilomar Conference Aug. 22-25, 2017

And I would be interested in seeing your presentation. Thx

Driving Innovation in Clean Transportation

On Jun 15, 2017, at 9:10 AM, Ellies, Ben <ellies.ben@epa.gov> wrote:

Thanks Karl! It went well. Lots of people were very engaged. If you haven't seen the presentation I can send it to you.

On the message you forwarded below, is there something I should do with this? I clicked on the Asilomar agenda and it's all password protected.

Thanks,
Ben

From: Simon, Karl
Sent: Thursday, June 15, 2017 8:58 AM
To: Ellies, Ben <ellies.ben@epa.gov>
Subject: FW: Registration Reminder: Asilomar Conference Aug. 22-25, 2017

Well done Ben! I heard a lot of good feedback from your presentation

From: Dan Sperling [mailto:dsperling@pmta132.dedicated.bmsend.com] **On Behalf Of** Dan Sperling
Sent: Wednesday, June 14, 2017 4:40 PM
To: Simon, Karl <Simon.Karl@epa.gov>
Subject: Registration Reminder: Asilomar Conference Aug. 22-25, 2017

The linked image cannot be displayed. The file may have been moved, renamed, or deleted. Verify that the link points to the correct file and location.

Transportation Innovation and Policy in a Fragmenting World

August 22-25, 2017

Dear Asilomar Invitee:

We hope to see you at the sixteenth biennial Asilomar Conference on Transportation and Energy, *Transportation and Energy Policy in a Fragmenting World*, August 22–25. I am writing to remind you that registration fees will increase by $100 on July 1 to $500 for participants from government, academia or NGOs, and $650 for participants from industry. Conference center lodging and food rates will remain the same. An **updated agenda** is available on the Asilomar Conference website.

To register, please click here.

Registration scholarships may be available for participants from government and non-governmental organizations. These scholarships are made possible by a generous grant from the Energy Foundation. Please contact Asilomar Conference Coordinator Natalie Ruiz at natruiz@ucdavis.edu for information on scholarships or questions about registration.

Please check the conference website periodically for updates. We look forward to seeing you at Asilomar in August.

Sincerely,

Dan Sperling

Conference Host
Distinguished Professor and Founding Director, ITS-Davis

Message

From: Alson, Jeff [alson.jeff@epa.gov]
Sent: 6/15/2017 9:45:17 PM
To: Simon, Karl [Simon.Karl@epa.gov]; Charmley, William [charmley.william@epa.gov]
CC: Moran, Robin [moran.robin@epa.gov]; Snapp, Lisa [snapp.lisa@epa.gov]; Birgfeld, Erin [Birgfeld.Erin@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Yanca, Catherine [yanca.catherine@epa.gov]
Subject: Draft piece for Tuesday prep for CAR/Traverse City talk
Attachments: CAR Traverse City_Prep for Chris_draft.docx

Meeting with Chris is on Tuesday at 4. A few of us brainstormed possible themes for Chris' talk at CAR, and we decided to get Chris' reaction before spending time on slides or talking points. Note that some of these same themes will likely be relevant to OTAQ participation at Asilomar. Robin drafted the attachment and I made a few edits. Robin is out until Tuesday, and I am out until Monday. If you have comments, revise the attachment and send back around, or send general comments to me and I will incorporate them on Monday.

CAR Traverse City – MTE Panel

Prep for Chris, 6/20/17

__Full Program__ *[note 4 sessions on CAV, Electrification, Mobility]*

Monday, July 31
[HYPERLINK "http://www.cargroup.org/mbs/schedule/world-class-manufacturing/"] – 8 a.m. – noon
[HYPERLINK "http://www.cargroup.org/mbs/schedule/world-class-manufacturing-technologies/"] – 1 – 4:30 p.m.
[HYPERLINK "http://www.cargroup.org/mbs/schedule/connected-and-automated-vehicles/"] – 1 – 4:30 p.m.

Tuesday, August 1
[HYPERLINK "http://www.cargroup.org/advanced-powertrain-forum-an-electrification-tipping-point/"] – 8 a.m. – noon
[HYPERLINK "http://www.cargroup.org/mbs/schedule/north-american-market/"] – 8 a.m. – noon
[HYPERLINK "http://www.cargroup.org/mbs/schedule/fuel-economy-and-ghg-emissions/"] 1–4:00
[HYPERLINK "http://www.cargroup.org/mbs/schedule/from-car-company-to-mobility-company/"] – 1 – 4:00 p.m.

Wednesday, August 2
[HYPERLINK "http://www.cargroup.org/mbs/schedule/strategy-leading-in-a-transitional-world/"] – 8:30 a.m. – noon
[HYPERLINK "http://www.cargroup.org/mbs/schedule/automotive-trade/"] – 1:30 – 4:00 p.m.
[HYPERLINK "http://www.cargroup.org/mbs/schedule/the-car-of-tomorrow/"] – 1:30 – 4:00 p.m.

Thursday, August 3
[HYPERLINK "http://www.cargroup.org/mbs/schedule/strategies-for-success/"] – 8:30 a.m. – 12:30 p.m.

__MTE Policy Panel__
__Fuel Economy and Greenhouse Gas Emissions: Where does Policy go now? And, will the Market Follow?__
Tuesday, August 1, 1 p.m. – 4 p.m.

A new U.S. administration brings a different perspective regarding fuel economy and greenhouse gas emissions. With this new perspective comes strategic opportunity and great challenge. Regardless of U.S regulations, the automotive industry likely faces increasingly stringent GHG regulation globally. This session will bring together key stakeholders to debate and illuminate the pathway to an effective, cohesive, and achievable national fuel economy and greenhouse gas policy.

- Hear firsthand as regulators and industry representatives layout their case for effective fuel and emission regulation.
- Gain a better understanding of the role states may play in setting stronger emissions regulation.
- Learn where there may be common ground to move forward.

Chair:
[HYPERLINK "http://www.cargroup.org/person/brett-smith/"]
Assistant Director, Manufacturing, Engineering & Technology Group, **Center for Automotive Research**
Speakers:
[HYPERLINK "http://www.cargroup.org/person/mitch-bainwol-2/"]
President & CEO, **Alliance of Automobile Manufacturers**
[HYPERLINK "http://www.cargroup.org/person/robert-bienenfeld/"]
Assistant Vice President, Environment & Energy Strategy, **American Honda Motor Co., Inc.**
[HYPERLINK "http://www.cargroup.org/person/john-bozzella/"]
President & CEO, **Global Automakers**
[HYPERLINK "http://www.cargroup.org/person/christopher-grundler/"]
Director, Office of Transportation and Air Quality, **U.S. Environmental Protection Agency**

[HYPERLINK "http://www.cargroup.org/person/annette-hebert/"]
Chief, Emissions Compliance, Automotive Regulations and Science (ECARS) Division, **California Air Resources Board**
[HYPERLINK "http://www.cargroup.org/person/diarmuid-oconnell/"]
Vice President, Business Development, **Tesla**
[HYPERLINK "http://www.cargroup.org/person/ann-wilson/"]Senior Vice President for Government Affairs, **Motor and Equipment Manufacturers Association**

Format

- Each panelist speaks for 10-12 minutes, may use PowerPoint
- Panel discussion *[Asked Brett Smith to send key questions]*

Potential Key Themes

- EPA's mission remains the same
- MTE process: awaiting guidance on next steps in process; we're eager to re-engage; data-driven
- Manufacturer progress thus far: MY2016 compliance preview
- Jobs: Several recent studies -- we're looking at all the data (CAR, IU, BGA)
- Other major global auto markets are moving ahead
- Change is coming

- **EPA's mission remains the same** *[1 slide: The Earth]*
  - Our job is to protect public health and environment
  - Important role of NVFEL in ensuring level playing field for manufacturers for certification and for consumers in terms of fuel economy and emissions performance

- **MTE Process** *[1 slide]*
  - Administrator Pruitt's reconsideration of the Final Determination by April 2018
  - We await further senior leadership guidance on the next steps in the process.
  - We're listening. We're eager to re-engage. We're looking at all the new data. The process continues to be data-driven.

- **Manufacturer progress thus far: MY2016 preview** *[2-3 slides]*
  - Continued rapid technology advancement *[Slide]*
    - (Aaron H will gather latest Trends data on preliminary MY2017 technology adoption)
  - Case study of cleanest vehicles meeting future standards *[Slide]*
    - (e.g., MY2017 CRV meets standards out to 2022; Aaron checking if there are other new examples such as MY 2018 Camry)
  - MY2012-2015: Mfrs outperformed standards in first 4 years as sales increased each year
  - MY2016: First year we're seeing shortfall in this MY (-10 g/mi fleetwide).

    Ex. 5 Deliberative Process (DP)

    - For next couple years, stringency increases far less than for 2014-2015-2016, especially for trucks (MY 2017 truck standard is only very slightly more stringent)
  - Need to get to about 36 mpg, or about 1 mpg per year, in MY 2025
- **Jobs** *[1 Slide]*
  - Several new studies released recently *[Slide w/pictures all the covers]*
    - CAR (infamous 1 Million job loss based on $6,000 vehicle costs)

        - Indiana University (positive macroeconomic impacts longer term)
        - BlueGreen Alliance/NRDC (288,000 jobs today supporting clean vehicle technology across 1,200 facilities in 48 states)
    - We're looking at all the data
    - EPA's assessement of the CAR model: Its all about the input assumptions.
        - Using our MTE cost estimate, we see positive vehicle sales and job growth *[Slide of Results]*

- **Other countries are moving ahead with more stringent standards**
    - Could show ICCT slide comparing standards in various countries

- **Change is Coming** *[1 Slide]*
    - [Lisa/Aaron – could point to all the CAR sessions on CAVs, Mobility etc]
    - Ex. 5 Deliberative Process (DP)

Message

From: Moran, Robin [moran.robin@epa.gov]
Sent: 10/30/2017 8:08:00 PM
To: OTAQ Materials [OTAQMaterials@epa.gov]
CC: Charmley, William [charmley.william@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Alson, Jeff [alson.jeff@epa.gov]; Snapp, Lisa [snapp.lisa@epa.gov]; Barba, Daniel [Barba.Daniel@epa.gov]; Orlin, David [Orlin.David@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]; Buchsbaum, Seth [buchsbaum.seth@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]
Subject: Material for Chris's MTE briefing tomorrow (10/31) 10am
Attachments: MTE Public Comment Summary_briefing for Grundler 103117_v3.pptx

For Chris's 10am MTE meeting tomorrow (10/31), we will review the attached preliminary report out of the MTE comments. The MTE team still continues reviewing the public comments and will likely have more details to provide at a later time.

We also plan to provide a debrief on the MTE meeting with NHTSA that occurred last Wednesday, and discuss next steps.

Thanks,
Robin

Robin Moran
Senior Policy Advisor
U.S. EPA, Office of Transportation and Air Quality
2000 Traverwood Dr.
Ann Arbor, MI 48105
(734) 214-4781 (phone)
(734) 214-4821 (fax)

Message

From: Moran, Robin [moran.robin@epa.gov]
Sent: 11/2/2017 8:08:10 PM
To: OTAQ Materials [OTAQMaterials@epa.gov]
CC: Charmley, William [charmley.william@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Orlin, David [Orlin.David@epa.gov]; Buchsbaum, Seth [buchsbaum.seth@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Lieske, Christopher [lieske.christopher@epa.gov]; Alson, Jeff [alson.jeff@epa.gov]; Snapp, Lisa [snapp.lisa@epa.gov]; Barba, Daniel [Barba.Daniel@epa.gov]
Subject: Materials for Chris's Monday 11/6 4pm MTE Monthly Update
Attachments: MTE Public Comment Summary_briefing for Grundler 110617_final.pptx

Attached is the briefing we will use for our Monday, 11/6, 4pm MTE Monthly Update. It's a revised version of the MTE Comments Summary, which we began with Chris during our meeting earlier this week.

Thanks,
Robin

Robin Moran
Senior Policy Advisor
U.S. EPA, Office of Transportation and Air Quality
2000 Traverwood Dr.
Ann Arbor, MI 48105
(734) 214-4781 (phone)
(734) 214-4821 (fax)

Message

From:	Moran, Robin [moran.robin@epa.gov]
Sent:	11/15/2017 9:41:42 PM
To:	OTAQ Materials [OTAQMaterials@epa.gov]
CC:	Charmley, William [charmley.william@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Alson, Jeff [alson.jeff@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Orlin, David [Orlin.David@epa.gov]; Kataoka, Mark [Kataoka.Mark@epa.gov]; Buchsbaum, Seth [buchsbaum.seth@epa.gov]
Subject:	For Chris's Review: Draft MTE Briefing for AA
Attachments:	MTE Briefing for AA Wehrum_draft2.pptx; MTE Public Comment Summary_briefing for AA Wehrum.pptx

Attached are two materials for Friday's briefing with the AA.

1) MTE overview briefing, including OTAQ technical work supporting MTE and process to date
2) The MTE comments summary briefing, which I presume we could send up as a reference, but offer to go through at a later date.

Let us know if you'd like to talk about these tomorrow.

Thanks,
Robin

Robin Moran
Senior Policy Advisor
U.S. EPA, Office of Transportation and Air Quality
2000 Traverwood Dr.
Ann Arbor, MI 48105
(734) 214-4781 (phone)
(734) 214-4821 (fax)

Message

From: Burke, Susan [Burke.Susan@epa.gov]
Sent: 12/11/2017 3:04:35 PM
To: Simon, Karl [Simon.Karl@epa.gov]
CC: Dupree, Sheena [Dupree.Sheena@epa.gov]; Snapp, Lisa [snapp.lisa@epa.gov]; Lie, Sharyn [Lie.Sharyn@epa.gov]; Alson, Jeff [alson.jeff@epa.gov]; Kenausis, Kristin [Kenausis.Kristin@epa.gov]; Cleveland, Meredith [Cleveland.Meredith@epa.gov]; Froman, Sarah [Froman.Sarah@epa.gov]; Daniels, Jessica [daniels.jessica@epa.gov]; Bunker, Amy [Bunker.Amy@epa.gov]
Subject: Materials for 11 AM ZEV briefing
Attachments: CASC ZEV Team Work Plan 12.11.17.docx; CASC ZEV Briefing (12.11.17).pptx

Hi Karl,

Materials for our 11 AM meeting are attached. I'll print copies for DC.

Thanks,
Susan

CASC ZEV PROJECTS

RECENT ACCOMPLISHMENTS & FY18 WORK PLAN

BRIEFING FOR DIVISION DIRECTOR 12.11.17

[redacted]

AGENDA

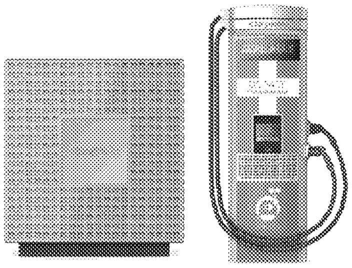
- Analysis Highlights
  - Study on extreme fast chargers
  - Future DCFC needs by connector
  - ZEV access in rental fleets, carshare, & rideshare programs
  - ZEV initiatives in underserved communities
- Education and Outreach Highlights
  - Completed web updates
  - Planned brownbags and other opportunities
- Other highlights: stakeholder outreach
- FY18 Workplan

Shout Out: Our GVG video on EVs & PHEVs was recently picked up by the Sacramento Bee and a CA utility

FUTURE MOBILITY RESEARCH WITH RTI

- Contract with RTI: Zero Emission Vehicles & Future Mobility Research
  - Work assignment written broadly to support projects related to emerging trends in transportation sector: ZEVs, shared mobility, and CAVs
  - FY 2017–18 work focused on ZEVs
  - Objectives:
    - Better understand environmental impacts associated with new trends in ZEV infrastructure
    - Fill knowledge gap on future DCFC needs by connector type
    - Understand current ZEV access opportunities for consumers (carshare, rideshare, rental fleets)
    - Understand ZEV initiatives, and challenges, in underserved communities
    - Receive ad hoc support on other future mobility topics

UNDERSTANDING ENVIRONMENTAL IMPACTS OF EXTREME DCFCS



ChargePoint's Express Plus platform will deliver up to 400 kW charge and is modular so that infrastructure owners can start small and grow easily over time. (Source: ChargePoint via RTI)

- Goal: Analyze the potential environmental impacts of ≥ 300 kW DC Fast Chargers (XFCs) for electric vehicles with and without measures to reduce peak demand such as managed charging, onsite energy storage and onsite renewable electricity generation.
- Why? We know XFCs are coming:
  - ChargePoint: 400 kW DCFCs will be available later this year
  - eVGo: 150 kW DCFC systems, upgradable to 350 kW
  - EA is deploying 150 kW/320kW stations first cycle
  - Tesla superchargers: 145 kW, plans for >350 kW
  - Coalition of OEMs installing 350 kW stations in Europe
- DOE labs studying many aspects related to XFCs— technical considerations, grid impacts, business case, rate structures—but not environmental impacts

UNDERSTANDING ENVIRONMENTAL IMPACTS OF EXTREME DCFCS

- **Timeline:** Initial results by end of March, report out by end of July
- Modeling: UC Davis (subcontractor) will run economic dispatch model for multiple EV charging scenarios in 2030
- **Charging scenarios:**
  - BAU: mostly home charging, some workplace, small public DCFC
  - High XFC scenario with no mitigation measures
  - High XFC scenario with measures to mitigate peak demand: managed charging, onsite energy storage and/or renewable generations

  Possible sensitivities on EV adoption and grid mix
- Work should inform OAP-OTAQ EV scenario modeling

Key considerations for XFC

- How many EVs will be on the road? Where will they be located?
- Where and when will EV drivers charge?
- What are the resulting load profiles for short duration, high-power charging?
- How will power sources shift under these load profiles?
- How much peak demand can be reduced with managed charging, onsite energy storage, and renewable generation?
- Where can these measures be deployed?

FUTURE DCFC NEEDS BY CONNECTOR

Will fast charging stations still need to provide both CCS and CHAdeMO in 2025? 2030? If so, what ratio of connectors makes sense?

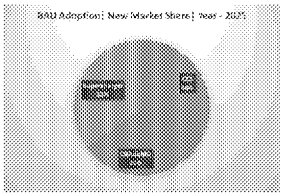
- We analyzed multiple scenarios out to 2030, varying PEV market shares by manufacturer and making different assumptions for if, and when, different OEMs might move to a common standard (CCS)

SAE Combo (CCS)	CHAdeMO	TESLA Supercharger
Audi, BMW, GM, Ford, Daimler, Fiat-Chrysler, Honda, Hyundai, MINI, Porsche, Volkswagen	Nissan, Mitsubishi, Subaru, Toyota, Kia, Mazda	*Tesla

*Tesla joined the CCS association in 2016, and currently has an adaptor to CHAdeMO

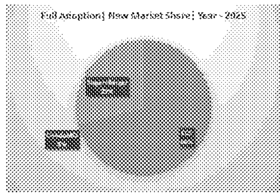
FUTURE DCFC NEEDS BY CONNECTOR

- In most scenarios explored, a significant number of vehicles on the road still use CHAdeMO. This suggests continued need for both CHAdeMO and CCS support over the next decade.



Locks in today's DCFC types (plus Toyota)

Assumes all OEMs except Nissan, Mitsubishi, and Tesla switch to CCS by 2020 (Nissan & Mitsubishi switch in 2025)



Assumes all OEMs eventually switch to CCS

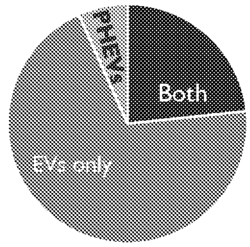
- Spreadsheet tool will allow us to update scenarios over time to reflect latest OEM announcements

TRACKING ZEV ACCESS

- Tracking rideshare, rental car agencies, and other shared fleets that provide access to EVs, PHEVs, and FCVs

- The contractors identified 33 publicly available programs that include ZEVs
  - 27 are currently operational
  - 19 operate in more than one city; most common cities: LA, San Francisco, Chicago, and D.C.

  - Most programs have only EVs:
    - Nissan Leaf; then BMW i3, Tesla S
  - A few programs also have PHEVs;
    - Chevy Volt; then Toyota Prius
  - No programs have FCVs



- Considering adding info to EPA's GVG website

TRACKING ZEV ACCESS

Examples:

- GM's Maven Gig provides flexible leases and rental cars for rideshare and delivery drivers. Chevrolet Bolt EV rentals include free charging (for a limited time).
- Uber began an EV Ambassadors program in Portland that provides drivers that go electric with the opportunity to earn more while driving by educating riders about the benefits of EVs.
- Lyft Express Drive allows drivers to lease Hertz and GM vehicles—including the Chevrolet Bolt and Volt— with no cap on miles for Lyft driving.
- Rental car companies Alamo, National, and Enterprise have EV options (like the Nissan Leaf) in select locations.

* Sixt is a rental car company in at least 50 U.S. cities with electric vehicles models such as the BMWi3, Tesla Model S, and BMW i8.

TRACKING ZEV PROJECTS IN UNDERSERVED COMMUNITIES

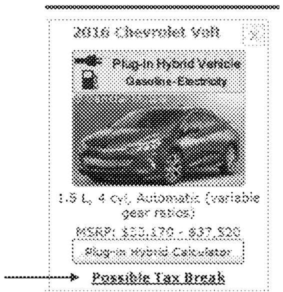
- The contractors identified over 10 programs (most in California) that promote ZEVs in underserved communities
  - CARB is the most active agency in this space, using revenues from the state's cap and trade program to finance pilot projects
  - Four of nine states with ZEV mandates have programs
  - Several states and cities have expressed interest but are waiting to learn from California's experiences

- Programs generally provide purchase incentives (rebates and loans), carsharing, incentives for charging station infrastructure, education, and advocacy

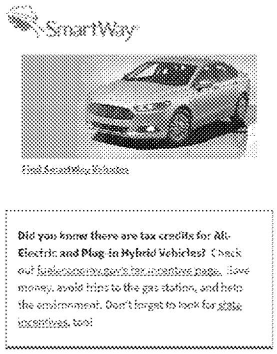
- Obstacles and challenges for low-income families include:
  - Misconceptions about ZEVs (e.g., two-seaters are not big enough to carry families)
  - Cultural role of cars and driving in disadvantaged communities (e.g., many informally share cars)
  - Upfront costs and a lack of access to and literacy about financing
  - Lack of charging infrastructure in low-income neighborhoods
  - Smart phone and bank account access
  - Insurance issues
  - Business risk

ZEV EDUCATION & OUTREACH – ENHANCED WEB CONTENT

1. Integrated tax incentive link into fe.gov vehicle searches



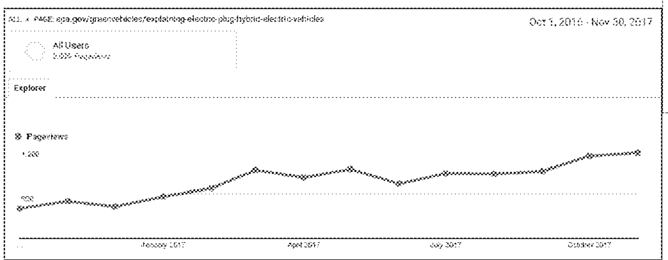
2. Added tax incentive links on GVG

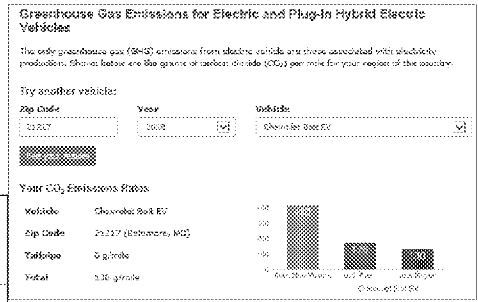


3. Updated GVG fuel cell page

ZEV EDUCATION & OUTREACH – PENDING ACTIVITIES

1. EV range content for GVG (imminent)
2. EV myths factsheet
3. Update PEV calculator on fe.gov
4. Brownbag on Upstream Emissions for EVs
5. Hydrogen brownbag, including potential test ride – Spring 2018





STAKEHOLDER ENGAGEMENT & OTHER HIGHLIGHTS

Recent Highlights

- Continued participation in interagency work groups of hydrogen and fuel cells
- Served in advisory role in NESCAUM Campaign
- Regularly invited to serve as reviewer(s) for external papers related to ZEVs and ZEV Infrastructure
  - NREL, CARB, TRB, TE3, VTO
- Participated as invited reviewer to DOE VTO Annual Merit Review last June

Upcoming Opportunity

- Invitation to present at a new interagency track during the DOE Fuel Cell Technologies Office's Annual Merit Review next June

Message

From: Moran, Robin [moran.robin@epa.gov]
Sent: 1/2/2018 8:40:09 PM
To: OTAQ Materials [OTAQMaterials@epa.gov]
CC: Charmley, William [charmley.william@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Alson, Jeff [alson.jeff@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Barba, Daniel [Barba.Daniel@epa.gov]
Subject: Material for Chris's 4pm Today: MTE Bi-Weekly
Attachments: MTE biweekly w Grundler_20180102_Final.pptx

Below is the agenda for our 4pm MTE meeting with Chris, and materials are attached. Thank you!

January 2, 2018 MTE Bi-Weekly w/Chris Grundler

AGENDA

- Any updates on process?
- Debrief on CA meeting
- Upcoming Stakeholder meetings w/Wehrum:
- Global Automakers: **Wednesday, January 3, 1-2pm**
- North American International Auto Show (Detroit): Tuesday, January 16
- Pre-brief for Toyota/Honda meetings: Monday, January 22, 3-3:30pm
- Toyota: Tuesday, January 23, 1-2pm
- Honda: Tuesday, January 23 2-3pm

- MTE bi-weekly briefing w/Wehrum next Tuesday Jan. 9 -- Potential agenda:
- Update on latest modeling results
- Draft plan for Final Determination by March 30
    - Summary of public comments
    - FR notice - short notice articulating policy decision
    - Technical support?
- Pre-brief for Detroit Auto Show on Jan. 16

- Latest OMEGA results (see separate Powerpoint)

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Ann Arbor, MI 48105
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Message

From: Simon, Karl [Simon.Karl@epa.gov]
Sent: 1/12/2018 8:36:42 PM
To: Charmley, William [charmley.william@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]
Subject: 2018 NAIAS Primer 1-12-18.docx
Attachments: 2018 NAIAS Primer 1-12-18.docx

2018 North American International Auto Show Primer

Overview

The North American International Auto Show (NAIAS, or the Detroit Auto Show) is one of the largest auto shows in the world, and certainly one of the most important. Last year over 800,000 people attended the show, including more than 5,000 journalists. There were 71 vehicle introductions and 46 new vehicles were debuted to the world. Vehicle manufacturers use the show to promote their new and existing vehicles, and to showcase advanced technology offerings. Some manufacturers will show concept cars to gauge ideas for a future design direction for the brand, or simply to explore an outlandish design idea. While the true concept cars have been rarer in recent years, they always draw some of the most press and interest from the public. This year's NAIAS is likely to focus on pickup trucks, SUVs, automated technology, and electrification.

Pickup trucks have remained about 10-15% of the market for the last decade. The market is dominated by the Ford F-150, the Chevy Silverado, and the Ram 1500. These three vehicles are the best selling vehicles in the U.S. and highly profitable for their respective companies. With Chevy and Ram introducing redesigned versions, and Ford bringing back the Ranger truck, expect this year's NAIAS to heavily emphasize pickup trucks.

SUVs accounted for a record 41% of vehicles sold in MY 2016 and the NAIAS will undoubtedly reflect the growing popularity of SUVs with offerings from nearly every manufacturer on display. SUV fuel economy has been increasing with SUV popularity so it is likely fuel economy will be prominently advertised.

Automated vehicle technology will be front and center in many manufacturer's displays. This will include features like adaptive cruise control, lane departure assist, "supercruise", and automated parking. All of these technologies are building blocks for fully autonomous vehicles and it is likely that at least some manufacturers will bring an autonomous prototype vehicle.

The **Consumer Electronics Show** (January 9-12 in Las Vegas) precedes the NAIAS and has become another very important event for the automotive industry. This year at CES, about 25% of the massive show ("about half the size of the Vatican") will be automotive, and everything from artificial intelligence, infotainment, and autonomous technologies will be on display. Ford CEO Jim Hackett is a headline speaker and autonomous vehicles will be providing transportation around Las Vegas. Partly in response to the popularity of the Consumer Electronics Show, NAIAS added the **AUTOMOBILI-D** exposition, which showcases the "rapidly evolving global automotive and mobility landscape" and will bring together many advanced part suppliers, sensor manufacturers, and automotive companies.

Electrification (from fully electric vehicles to electrified accessory loads) will probably not be front and center at NAIAS, but it will likely be part of the show. Given some of the very bullish comments from automakers (i.e. 'The future is all electric" from GM) and potential bans on gasoline and diesel cars altogether (China), it will be very interesting to see what manufacturers will present.

Schedule

January 13 – **The Gallery** is an exclusive showing from premium manufacturers, including Aston Martin, Bentley, Ferrari, Lamborghini, Porsche, and Rolls Royce.

January 14 to 21 - **AUTOMOBILI-D** is an exposition focused on the rapidly evolving global automotive and mobility landscape including autonomous technologies, connected vehicles, ride hailing, and other technology developments.

January 14 to 16 – **Press Preview**. This is when most of the big unveilings take place. Last year more than 5,000 journalists from 60 countries witnessed 71 vehicle introductions, including 46 worldwide debuts.

January 17 to 18 – **Industry Preview**. The NAIAS is open to automotive professionals before it opens to the public.

January 19 – **Charity Preview.** Probably Detroit's biggest black-tie affair of the year.

January 20 to 28 – **Public Show.** Over 800,000 people attended NAIAS in 2017.

2 0 1 8
AUTOMOBILI-D / PUBLIC SHOW FLOOR PLAN

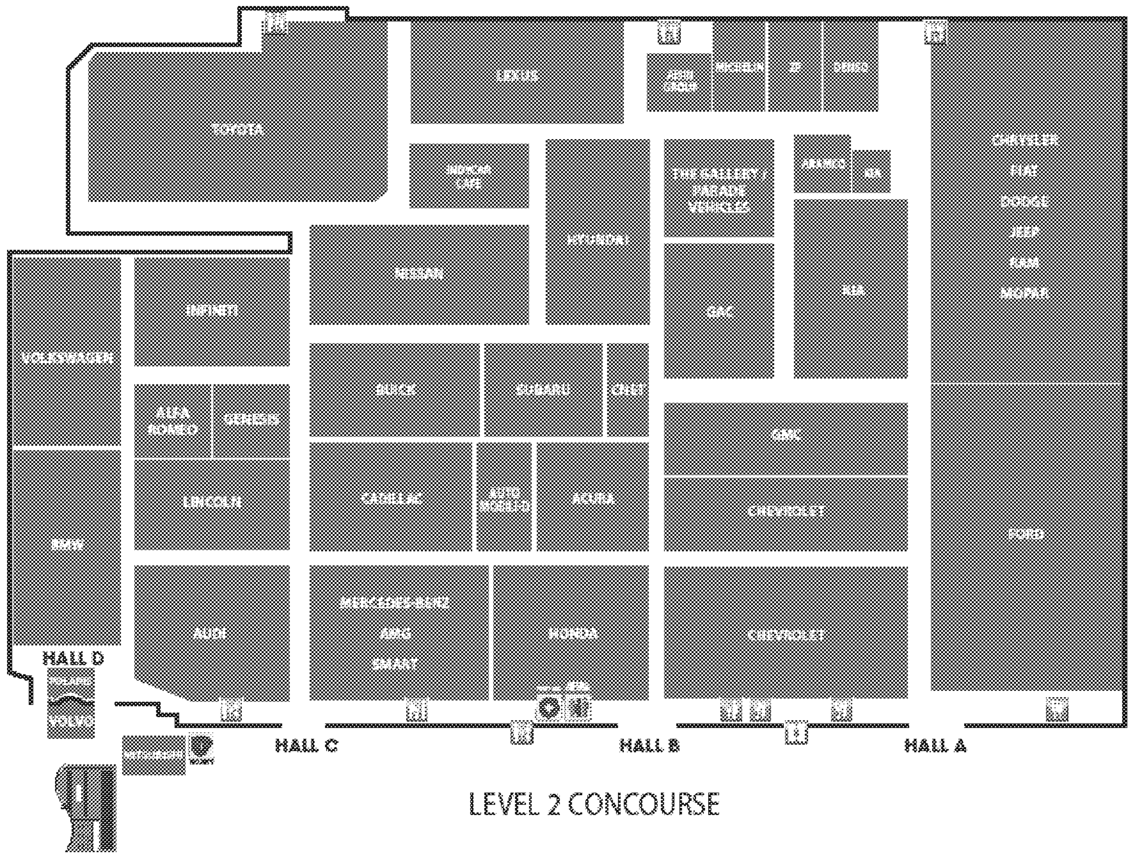
NORTH AMERICAN INTERNATIONAL
AUTO SHOW.

autoMOBILI-D
NAIAS DETROIT

LEVEL 1

- AUTONOMOUS DRIVING
- CONNECTED CAR
- E-MOBILITY
- MOBILITY SERVICES
- UNIVERSITIES & ASSOCIATIONS
- SMART CITIES

planet M
MICHIGAN ECONOMIC DEVELOPMENT CORPORATION



LEVEL 2 CONCOURSE

AUTOMOBILI-D: Saturday, January 20 – Sunday, January 21

PUBLIC SHOW: Saturday, January 20 – Sunday, January 28

Floorplan as 12-19-17

EPA/CARB NAIAS Tour Schedule

Cobo Center, Detroit

Tuesday, January 16, 2017

8:00 – 8:20:	**Meet at Joe Louis Statue**	
	Company	**Key Representatives**
8:30 – 8:50:	Mercedes Benz	Dr. Christian Hahner, Director of Certification & Regulatory Affairs, Daimler AG Ulrich Heine, VP of Testing and Regulatory Affairs, Mercedes-Benz Research & Development North America
9:00 – 9:20:	BMW	Lisa Errion Saums, VP, Government and External Affairs, The Americas
9:30 – 9:50:	Volkswagen	David Geanacopoulos, Sr. EVP, Public Policy, VW of America
10:00 – 10:20:	Toyota	Rick Gezelle, National Manager, Technical and Regulatory Affairs
10:30 – 10:50:	Nissan	Scott Becker, Senior VP, Administration, Nissan North America Mike Bunce VP, Product Planning, Nissan North America
11:00 – 11:20:	Hyundai	Mike O'Brien, Senior VP of Product Development
11:30 – 12:00:	Subaru	Maurice Arcangeli, Director, Government Relations
12:00 – 12:50:	**LUNCH BREAK**	
	Company	**Key Representatives**
1:00 – 1:20:	Kia	Michael Sprague, COO and EVP Orth Hendrick, VP, Product Planning
1:30 – 1:50:	Denso	Doug Patton, Executive Vice President, Engineering & CTO Bill Foy, SVP Engineering
	FCA (formerly Chrysler)	Mark Chernoby, Chief Technical Compliance Officer

2:00 – 2:20:		Shane Karr, Head of External Affairs
2:30 – 2:50:	Ford	Kim Pittel, Group VP, Sustainability, Environment and Safety Engineering Curt Magleby, VP, Government Affairs
3:00 – 3:20:	General Motors	Dan Turton, GM North America Vice President, Public Policy Bob Babik, Executive Director, Global Regulatory Affairs Tim Herrick, Executive Chief Engineer, Next Gen Full-Size Trucks Lyndon Lie, Chief Engineer, Cadillac Product Programs
3:30 – 4:00:	Honda	Ed Cohen, Vice President, Government and Industry Affairs

Tour Leaders:

Auto Alliance: Steve Douglas, Chris Nevers

Global Automakers: Julia Rege, Amandine Muskus

WHAT: **Tuesday Night Reception/Dinner**

WHEN: Tues., Jan. 16, 2018: 6:30pm Reception: 7:15pm Dinner

WHERE: Wright and Co. Restaurant: 1500 Woodward Avenue: 2nd Floor

Pick-up Time for OAR Leadership: 7:15am at hotel, Bill Charmley (mobile 734 545 0333)

OAR Leadership ride to hotel in Ann Arbor on Tuesday night from Karl Simon (mobile 202 302 4616)

EPA Press Day Preview Participation (updated on Jan 5, 2018)

- Mike Catanzaro, Special Assistant to the President for Domestic Energy and Environmental
- Bill Wehrum, Assistant Administrator, EPA Office of Air and Radiation
- Mandy Gunasekara, Principle Deputy Assistant Administrator, EPA Office of Air and Radiation
- Clint Woods, Deputy Assistant Administrator, EPA Office of Air and Radiation
- David Harlow, Counselor to the Assistant Administrator
- Chris Grundler, Director, Office of Transportation and Air Quality
- Karl Simon, Director, Transportation and Climate Division
- David Haugen, Director, Testing and Advanced Technology Division
- Bill Charmley, Director, Assessment and Standards Division

Tuesday Dinner Participation:

- Mike Catanzaro (?)
- Bill Wehrum
- Mandy Gunasekara
- David Harlow
- Chris Grundler
- Karl Simon
- Bill Charmley

- **What should we expect during our time with each OEM?**
    - We will be escorted around the auto show floor by representatives from the Auto Alliance, and the Global Automakers. They will take us from OEM to OEM and keep us on schedule
    - We will have 20-25 minutes with each company
    - Each company will have a handful of representatives, generally representing people within the company responsible for public policy, environmental policy, and/or government affairs. Depending on the auto company, we will also have senior leadership from a company's Product Development group
    - Auto companies generally will use their 20 minutes to:
        - Provide an overall message to EPA – (e.g., thank you for revisiting the MTE Final Determination, we are supportive of X, and looking forward to continued engagement)
        - Tell us about the company's overall strategy for future products and environmental compliance
        - Show us one or 2 new vehicles that they are introducing at the Detroit Auto Show, and how those products reflect the company's strategy
- **What's a Reveal?**
    - During the Press Days, what we will see at each auto companies display will depend on where they are at in their "reveals" schedule
    - A "reveal" is a scheduled event, that the press is informed of, where a company will have 20-30 minutes of making a splash with a new announcement
    - A reveal can be the first public showing of a brand new vehicle, or a future prototype
    - In general, a new product reveal will not be available to customers in the show room for another 6-9 months
    - If a Reveal is happening near the time of our meeting with an OEM, they may only have 2 or 3 vehicles being displayed on a stage, with chairs set up for a hundred or so press folks
    - If a Reveal isn't happening, an OEM may have dozens of vehicles out for display
- **The Press on Press Day**
    - the EPA team is visiting the Auto Show on PRESS DAY – there will be thousands of reporters, from all over the world, everywhere
    - The Press includes bloggers, industry trade magazines, traditional newspapers and radio channels, and the major national press that have auto journalists (Wall Street Journal, LA Times, Detroit News, AP, etc)

- Bill Wehrum and Mike Catanzaro should be prepared that they may be recognized, and asked for an impromptu interview – we have seen this happen many times over the years
- EPA leadership should also realize that in the 20-25 minutes with each auto company, while the companies will try to make the discussion tailored just to the EPA tour group, they may have limited success in walling off others from hearing their messages. It all depends on what is going on at each individual OEMs area of the show
    - For example, we recall one year with the EPA political leadership where Fiat/Chrysler CEO Sergio Marchionne was providing an overview of a new Chrysler vehicle to the EPA tour group, and suddenly there was a reporter for the Wall Street Journal wedged between the OAR Assistant Administrator and OTAQ Office Director with a recorder in hand, taping the entire presentation

Key Technology Definitions and Terms

GDI – Gasoline Direct Injection is an engine technology where gasoline is sprayed directly into the cylinder. About 50% of new vehicles feature GDI, and this is increasing quickly.

Turbo – Turbocharged engines are often paired with GDI to allow for a "turbo-downsized" engine that can take advantage of the efficiency of a smaller engine, but the power of a larger engine when needed.

Cylinder Deactivation – Engines with cylinder deactivation can stop fuel flow to individual cylinders, allowing a larger engine to act like a smaller engine when full power is not required (for example an 8-cylinder engine could shut off 2 cylinders to act like a more efficient 6-cylinder engine during highway cruising)

Non-Hybrid Stop/Start – Many engines can turn off when a vehicle is at a stop or coasting and seamlessly turn back on as soon as pressure is applied to the gas pedal. This reduces fuel used during idling.

CVT – Continuous Variable Transmissions use a pulley system that does not rely on discrete gears, allowing for an infinite number of gear ratios for smoother accelerations and optimized operation at any vehicle speed. Almost 25% of new vehicles will feature CVTs.

7+ speed transmission – Transmissions with more speeds allow for more flexibility when optimizing how a vehicle shifts gears, and can result in significant fuel savings. About 25% of all new vehicles feature transmissions with 7 or more speed automatic transmissions.

Regenerative braking – Braking systems found on hybrid and electric vehicles where the resistance from an electric generator is used to slow a vehicle, creating electricity that can be stored and reused in the process.

Mild hybrids – Mild hybrid vehicles generally have limited hybrid capabilities, but can take advantage of some regenerative braking, have an electric motor that may provide some assistance to the gasoline engine, and can turn off the engine during idle or coasting. Mild hybrids cannot drive in an electric only mode.

Full hybrids – Full hybrids are vehicles that have a larger battery and more powerful electric motor, working in conjunction with a smaller gasoline engine. Most full hybrids, such as the Toyota Prius, can operate limited distances on electricity only.

PHEVs – Plug-in Hybrid Vehicles are vehicles that can operate on electricity stored in a battery or on gasoline. PHEVs can be plugged in and charged with electricity from an outlet or vehicle charger.

EVs – Electric Vehicles, such as the Tesla Model S and Chevy Bolt.

Utility Factor – All PHEVs have a utility factor that defines how much of the time an average driver will drive using primarily electricity.

FCVs – Fuel Cell Vehicles, which generally operate on hydrogen fuel.

AVs – Autonomous vehicles. Many additional acronyms are used for the combination of autonomous, connected, shared, and electric vehicles.

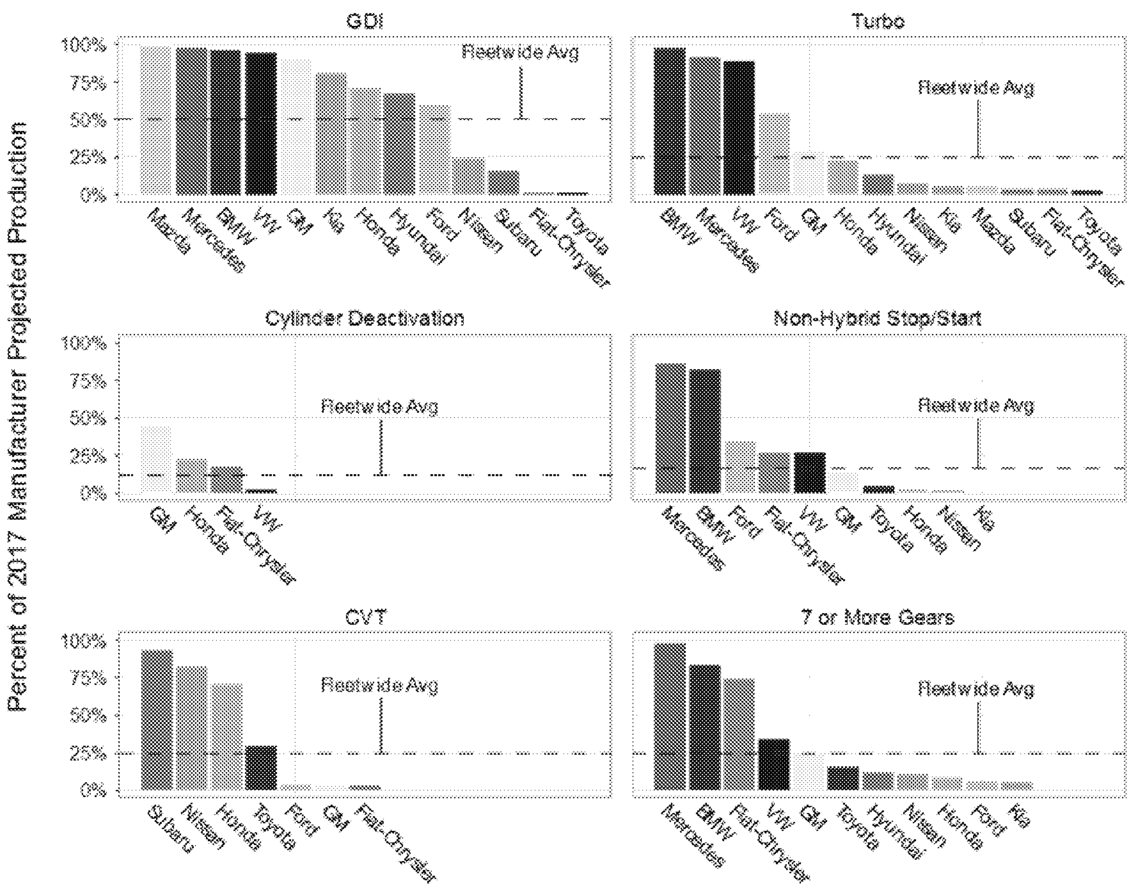
Key Industry Facts

- Vehicle sales were down 1.8% in 2017, after 7 years of increasing sales and record annual sales. 2017 was still one of the best sales years on record for the industry.

- Average new vehicle fuel economy for MY 2016 vehicles is at a record high of 24.7 mpg. Since model year 2004, fuel economy has increased 28% and in 10 of 12 years.

Automaker	2017	2016	Percent Change
General Motors	3,002,237	3,042,775	-1.3%
Ford	2,575,200	2,599,211	-0.9%
Toyota	2,434,515	2,449,630	-0.6%
Fiat Chrysler	2,073,073	2,256,849	-8.1%
Honda	1,641,429	1,637,942	0.2%
Nissan	1,593,464	1,564,423	1.9%
Hyundai-Kia	1,275,223	1,422,603	-10.4%
Subaru	647,956	615,132	5.3%
Volkswagen	625,068	591,063	5.8%
Mercedes-Benz	375,311	380,752	-1.4%
BMW	354,110	366,493	-3.4%
Mazda	289,470	297,773	-2.8%
Total	**17,245,872**	**17,553,429**	**-1.8%**

- Manufacturers are utilizing a wide variety of technologies to improve the fuel economy and performance of their vehicles. Different manufacturers are focusing on different technologies based on their vehicles and specific goals.



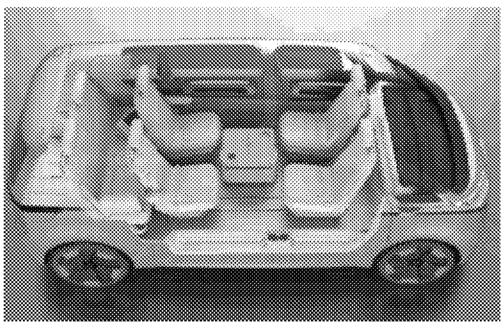
Autonomous Technology Background

Autonomous vehicles and automated vehicle technology are featured at the **Consumer Electronics Show** this year. Lyft will be providing autonomous vehicle rides between CES and the major hotels in Las Vegas. Alphabet's Waymo will be providing autonomous rides to the public using its shuttle service in Phoenix. The conversation for many manufacturers and suppliers is how to deploy and profit from the technology in the near future.

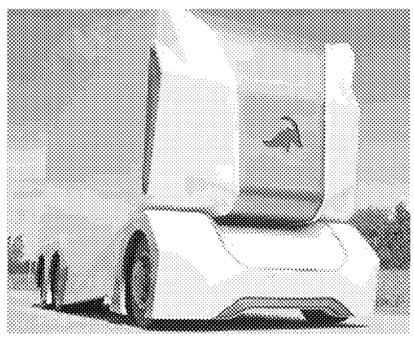
Vehicles that are on the road today already employ a wide variety of automated technologies. To capture the spectrum of technology from no automation to fully autonomous vehicles, the industry refers to the SAE levels of automation. The figure below is a simplified version of the definitions:

SAE Level	Name	Steering and Acceleration/ Deceleration	Monitoring of Driving Environment	Fallback Performance	All Driving modes
0	No Automation				
1	Driver Assistance		**Human Driver**		
2	Partial Automation				
3	Conditional Automation				
4	High Automation				
5	Full Automation		**Vehicle**		

At NAIAS this year, manufacturers will certainly be highlighting level 1 and level 2 automation technology that is going into cars being sold today. This includes options like lane keep assist, assisted cruise control, and automated parking. Some systems, such as Tesla's autopilot, Cadillac's Supercruise, and offerings from BMW, Mercedes, and Volvo are at least approaching level 3 automation. There will probably be some level 4/5 prototypes at NAIAS, but none are commercially available yet.



Volkswagen last year unveiled an electric, autonomous VW Bus concept that explored how an autonomous vehicle might be designed with a highly flexible interior. It was one of the most interesting vehicles of NAIS 2017 and it is highly likely another manufacturer will show a re-invented autonomous vehicle this year.



One other interesting autonomous vehicle unveiling that is expected at NAIAS this year is the T-Pod autonomous delivery vehicle (at **AUTOMOBILI-D**). Between the Consumer Electronics Show and AUTOMOBILI-D, there will probably be a wide range of automated passenger vehicles, transport vehicles, cargo vehicles, and drones.

Manufacturer Highlights

The following pages are a summary of the major vehicle launches expected at the 2018 NAIAS. This is based on press reports and rumors, and will not be a complete list. The manufacturers below are the 13 highest selling manufacturers (production of at least 150,000 vehicles) in the U.S. for model year 2016.

BMW (BMW, Mini, Rolls Royce)

Nearly all BMW vehicles now feature downsized turbocharged engines, most with 7+ speed transmissions and start/stop technology. BMW has stated publicly that they will offer 25 electrified vehicles, including 12 EVs by 2025.

2019 BMW i8 and i3

BMW will show the new i8 coupe and roadster editions of their plug-in hybrid supercar. They will also show an updated version of the electric i3

2018 BMW X2

BMW will also show the X2 small crossover vehicle that it will be bringing to the US in 2018.

Fiat Chrysler Automobiles (Chrysler, Dodge, Jeep, Ram, Fiat, Alfa-Romeo, Maserati)

FCA stock is up more than 20% in 2018 on rumors of a merger or purchase by Hyundai. FCA CEO Sergio Marchionne has long been looking for a corporate partner. News about this would be unexpected, but would be big headlines at the show if anything is announced.

2019 Jeep Cherokee

FCA will show the redesigned Jeep Cherokee. Jeep says it'll show more fuel-efficient engines for the Cherokee.

2019 Ram 1500

The redesigned Ram pickup truck should be stiffer, stronger, safer, and more efficient truck designed to go head-to-head with the Ford F-150 and new designs from General Motors.

Ford Motor Company (Ford, Lincoln)

2019 Ford Ranger and 2020 Ford Bronco

Ford is bringing back two iconic nameplates in the 2019 Ranger and 2020 Bronco. The 2019 Ranger will be based on the Ranger sold worldwide, which is a larger truck than the Ranger previously sold in the U.S. market. The Bronco will be released in 2020 as a competitor for the Jeep wrangler.

2018 Ford F-150

The F-150 has been the bestselling vehicle in the US for the last 35 years. The 2018 edition retains the heavy use of aluminum to save weight and a 10 speed transmission and is the first pickup to offer adaptive cruise control, blind spot monitoring, and lane-keep assist. Two new engines, a 3.3L and a 3.0L diesel, and possibly the hybrid variant might be shown at NAIAS.

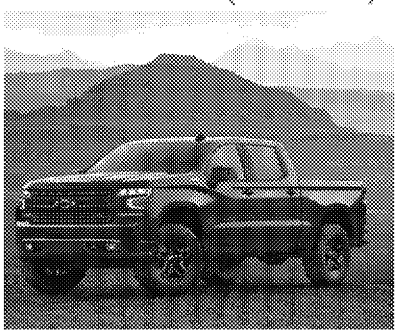
Mustang Bullitt GT

Ford will unveil the special edition mustang for the 50th anniversary of the Steve McQueen movie.

Autonomous vehicles

At CES Ford unveiled a new self-driving platform and "Transportation Mobility Cloud" intended to create a fleet of autonomous vehicles for partners from Lyft to Domino's Pizza. Ford may display something along these lines at NAIAS.

General Motors (Chevrolet, Cadillac, Buick, GMC)



2019 Chevrolet Silverado

The Chevy Silverado was the second bestselling vehicle in the US in 2017. The new version will be lighter than previous versions by using different aluminum and steel materials in higher-grade alloy, high-strength steel, and others. GM may introduce a carbon-fiber or carbon-fiber reinforced bed option for further weight savings. A 10-speed transmission will be available.

Mid-Engine Corvette

A mid-engine corvette supercar has long been rumored. GM is at least testing prototypes and could bring a version to the 2018 auto show. If this vehicle surfaces, it will be the biggest news at NAIAS.

Chevrolet Volt/Bolt

The Chevrolet Bolt has been increasing sales month by month as production has ramped up this year. GM has publicly stated they will have at least 20 EV models by 2023, and Mark Reuss, President of GM, has said "GM believes the future is all electric." Given GM's heavy investment in electric vehicles, autonomous technology, and car sharing it will be interesting to see what they announce or display at the auto show.

Honda Motor Company (Honda, Acura)

2019 Honda Insight prototype

The first hybrid to go on sale in the U.S. was the Honda Insight, a teardrop-shaped 2-seater that could easily get more than 60 mpg. Honda will show an updated version of the Insight planned for 2019.

Hyundai (Hyundai, Genesis)

Hyundai had the largest increase in fuel economy of any of the 13 largest manufacturers in the U.S. market for model year 2016, at 1.3 mpg.

Hyundai will show the **2019 Hyundai Veloster** sports coupe and the **2018 Kona**, which is a new small SUV.

Kia

Kia is showing a new Niro at the consumer electronics show, along with plans for electric and autonomous versions, and a new HMI (human machine interface) including Google Assistant.

Mazda

Mazda maintained their status as the most fuel efficient manufacturer (among the 13 largest) in MY 2016, at 29.6 mpg. Mazda will likely promote their SkyActive engines, including new turbocharged variants.

Mercedes Benz (Mercedes, Smart, Maybach)

G-class SUV

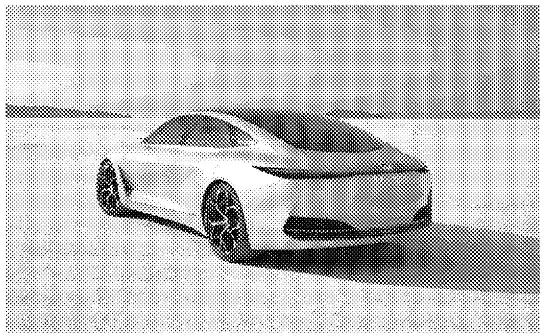
Mercedes will show a new version of their high end G-class SUV. It is rumored to be more fuel efficient with a possible mild hybrid powertrain. Expect the exterior to maintain its boxy proportions.

2019 Mercedes-AMG CLS53

The other likely Mercedes reveal is a performance oriented (AMG) sedan. Rumor is that these will be hybrid electric turbocharged 6 cylinder engines.

Nissan (Nissan, Infiniti)

Nissan will likely advertise that they are the most fuel-efficient "full line" manufacturer according to EPA. Nissan's definition of "full line" includes manufacturers selling full size trucks (this is a Nissan term, not an EPA definition). It's not clear what Nissan will show, except for an **Infiniti concept car** that will show design ideas for future Infiniti vehicles.



Subaru

No news on what Subaru might bring to NAIAS.

Toyota (Toyota, Lexus)

Toyota will show the **2019 Toyota Avalon**, which is a large sedan. Toyota is also expected to unveil their **Lexus LF-1 Limited** flagship crossover that "redefines the boundaries of luxury."

Volkswagen (VW, Audi, Porsche, Lamborghini, Bentley, Bugatti)

2019 VW Jetta

VW's top-selling U.S. model will make its world debut at the North American International Auto Show in Detroit. A new 1.4L turbo engine is expected, with a 6 or 8 speed transmission. Pre-collision braking, blind spot monitoring, rear parking assist, and adaptive cruise will likely be offered.

Electric Vehicles

VW has publicly made some very aggressive statements about electrification, and may show a new electric vehicle or concept at the auto show. Chief Executive Officer Matthias Mueller announced sweeping plans to build electric versions of all 300 models in the 12-brand group's lineup, vowing to spend $24 billion by 2030 to roll out the cars and another $60 billion to buy the batteries needed to power the vehicles.

Message

From: Snapp, Lisa [snapp.lisa@epa.gov]
Sent: 1/17/2018 7:09:16 PM
To: Simon, Karl [Simon.Karl@epa.gov]
CC: Burke, Susan [Burke.Susan@epa.gov]; Hula, Aaron [Hula.Aaron@epa.gov]
Subject: briefing materials for Japan visits
Attachments: Brief for visit to Yokohama Hydrogen Supply Chain.docx; Brief for Visit to toyota Test Track.docx

Karl—

Here are draft briefing materials for Sarah's trip to Japan. We split it into two pieces, one for the Toyota test track and one to the Yokohama Hydrogen facility. Toyota materials were coordinated with Robin. Please let us know if you would like any changes.

Thanks,
--Lisa

Driving Innovation in Clean Transportation

Visit to Toyota Test Drive Facility

Japanese automakers and the government of Japan are leaders in hydrogen fuel cell vehicles (FCVs). The Japanese automakers (Toyota, Honda, Nissan), major utilities, and Japanese government (through the Development Bank of Japan) are establishing a new company in the spring of 2018 to focus on development of a hydrogen recharging station network in Japan. The goal is to have 160 fueling stations and 40,000 fuel cell vehicles by 2020. Some reports indicate further goals from the government of up to 900 fueling stations and 800,000 vehicles (or about 1% of the vehicles on the road) by 2030. There are 91 hydrogen fueling stations and about 1,700 fuel cell vehicles on the road today. Japan offers incentives on fuel cell vehicles as high as $20,000 per vehicle.

Japan considers hydrogen a promising fuel for many applications beyond transportation. Currently, they import most of their petroleum, and hydrogen could be an efficient alternative. Japan also seems to be motivated to project itself as the global leader in clean energy for the 2020 Olympics in Tokyo.

Recent [HYPERLINK "https://www.nytimes.com/2018/01/09/business/japan-electric-cars.html?_r=0"] in the New York Times indicates Japan may be reconsidering their position on FCVs:

> "Japan is scrambling to ensure it has a future in an electric-car world. Toyota, the country's largest automaker, pioneered gasoline-electric hybrids but has long been skeptical about consumers' appetite for cars that run on batteries alone. Now, under pressure from foreign rivals like Tesla, the company says it is developing a batch of new electric models. The Japanese government has made managing the shift to next-generation vehicles a priority, but critics say its approach lacks focus. It has bet big on hydrogen fuel cells, an alternative technology to plug-in rechargeable batteries that is struggling to win widespread support. The fear is that once again, Japan will miss a big technological shift."

Despite having 2.5× the population of Japan, the U.S. currently has only around 40 hydrogen fueling stations in operation, almost all in CA; more are underway with CA providing funding to support 100 stations. Hydrogen provider Air Liquide and Toyota recently announced plans to deploy U.S. retail hydrogen stations in the Northeast. There are three hydrogen fuel cell vehicles available in the U.S.: Toyota Mirai, Honda Clarity, and Hyundai Tuscon. The U.S. is also researching fuel cells for military applications and has used fuel cells in the space program since the Gemini missions.

Many other manufacturers, including U.S. manufacturers, have focused on battery electric vehicles instead of fuel cell vehicles. There are 22 plug-in hybrid electric vehicles and 15 battery electric vehicles available in the U.S. at the end of 2017. EVs and PHEVs are a little over 1% of the U.S. market. The U.S. has more than 17,000 EV charging stations (47,000+ outlets) compared to around 120,000 gas stations.

Toyota Background

Toyota is one of the largest companies in the world. For 2017, Toyota ranked 5th on the list of Fortune Global 500 companies, with revenue of $254 billion and a profit of $17 billion. Toyota slipped to 2nd in global sales in 2017 (surpassed by VW), after leading 9 of the last 10 years (interrupted by the 2011 tsunami). Toyota had 2017 sales of just over 10 million vehicles, about 25% of which were sold in the U.S. In the U.S., Toyota was 3rd in sales in 2017. Toyota advertises spending of over $1 million every hour globally on R&D.

Toyota currently has 10 U.S. manufacturing plants that employed 136,000 people and built 1.4 million vehicles in 2016. Toyota (with Mazda) just announced that they will be building a new $1.6 billion assembly plant in Alabama, which is expected to add 4,000 jobs.

What are Toyota's views on the U.S GHG standards for light-duty vehicles?

Toyota is supportive of the EPA Administrator's decision to reconsider the Midterm Evaluation, to determine whether the standards for model years 2022-2025 vehicles are appropriate. Toyota believes that meeting the 2025 standards will require a significantly higher number of gasoline hybrid vehicles and plug-in electric vehicles than EPA had previously projected, and has expressed concern about the U.S. market acceptance of such vehicles. Toyota supports program flexibilities to help address market barriers, such as expanded credits and incentives for hybrids and electric vehicles.

Under EPA's GHG standard, Toyota ended MY 2016 with a large credit bank that was more than double any other manufacturer (78 million Mg). Toyota vehicles overall did not achieve their MY 2016 GHG targets and were required to use some credits (less than 5 million Mg). However, their large credit bank puts Toyota in an excellent position to be able to meet the future standards, even with little improvement to their current vehicles.

Toyota Mirai

The Mirai was introduced for sale in the U.S. in 2015. Currently, the vehicle is available only in California through select dealers, and only to select eligible customers. The Mirai currently leases for $349 a month for 36 months. It can be purchased for $57,500 before any incentives. Either price includes three years' worth of complimentary fuel.

The Mirai has a range of 312 miles on a full fill of hydrogen and takes about 5 minutes to refuel. Refueling time can be affected by ambient temperature and station hydrogen pressure. The vehicle achieves 67 mpg-e (miles of gallon per gasoline equivalent) on EPA fuel economy tests. The fuel cell is nearly silent, so the overall vehicle is very quiet. Like all electric motor driven vehicles, it likely has high low-end torque for a "zippy" driving feel.

In 2017 (through November), the Mirai sold (or leased) 1,542 vehicles. The other two fuel cell vehicles available in the U.S., the Honda Clarity and Hyundai Tuscon, sold 432 and 27 vehicles respectively.

U.S. Auto Manufacturers

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Fiat Chrysler: Fiat Chrysler has no announced FCV plans, but is apparently seeking to form a partnership with Hyundai that could include developing fuel cells.

Fuel Cell Advantages:

- Fuel cells utilize a chemical process, instead of combustion, that can much more efficiently capture energy to propel the vehicle.
- Automotive fuel cells generally run on hydrogen. Hydrogen can be created from many sources.
- FCVs can have ranges and refueling times comparable to gasoline vehicles.
- FCVs are very quiet and the only emissions are water vapor.
- Hydrogen vehicles should be at least as safe as gasoline vehicles. The tanks storing the hydrogen are extremely strong. The Toyota Mirai uses carbon-fiber wrapped tanks that absorb five times the crash energy of steel (Toyota has said that bullets actually bounce off the tanks). Hydrogen is much lighter than air so, in the event of a leak, hydrogen will dissipate into the air instead of pooling like gasoline.

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- Hydrogen fuel must be refined, generally from natural gas or water. This can be an energy intensive process with significant emissions, depending on the energy source. Novel approaches, such as using algae to produce hydrogen, are under research.
- Storing enough hydrogen for a full range requires high pressure storage tanks on board (10,000 psi), and refueling stations capable of providing high pressure hydrogen for refueling.
- Hydrogen tanks can be bulky.
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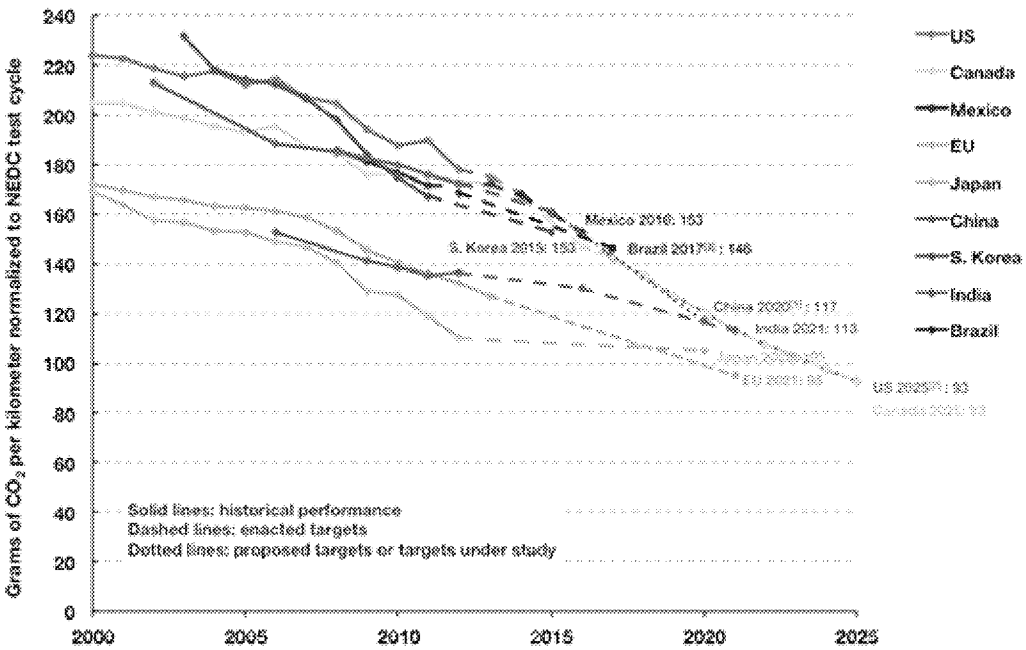
According to the ICCT, Japan currently has lower GHG (or higher fuel economy) standards than the U.S:



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[4] Supporting data can be found at: http://www.theicct.org/info-tools/global-passenger-vehicle-standards.

Message

From: Snapp, Lisa [snapp.lisa@epa.gov]
Sent: 1/17/2018 7:31:53 PM
To: Hengst, Benjamin [Hengst.Benjamin@epa.gov]; Sutton, Tia [sutton.tia@epa.gov]; Cook, Leila [cook.leila@epa.gov]; Burch, Julia [Burch.Julia@epa.gov]; Blubaugh, Jim [Blubaugh.Jim@epa.gov]
CC: Grundler, Christopher [grundler.christopher@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Hula, Aaron [Hula.Aaron@epa.gov]; Burke, Susan [Burke.Susan@epa.gov]; Moran, Robin [moran.robin@epa.gov]
Subject: Japan trip: briefing materials
Attachments: Brief for visit to Yokohama Hydrogen Supply Chain.docx; Brief for Visit to Toyota Test Track.docx

Ben and Tia,

Attached are briefing materials for Sarah's trip to Japan, which Karl has reviewed. We understand they are to go to Sarah and to Michael Heese by the end of the day. Of course, please let us know if you or others need any changes. Otherwise, we leave them in your capable hands.

Thanks,
--Lisa

Driving Innovation in Clean Transportation

Visit to Toyota Test Drive Facility

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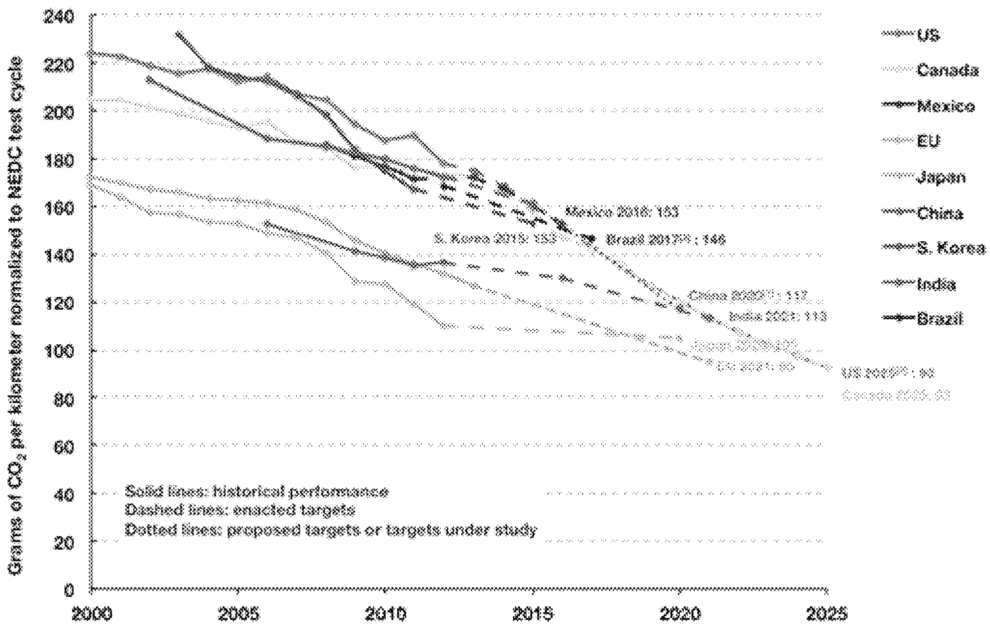

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[4] Supporting data can be found at: http://www.theicct.org/info-tools/global-passenger-vehicle-standards.

Message

From: Lie, Sharyn [Lie.Sharyn@epa.gov]
Sent: 2/13/2017 7:50:13 PM
To: Moltzen, Michael [Moltzen.Michael@epa.gov]; Levy, Aaron [Levy.Aaron@epa.gov]; Shell, Michael [Shell.Michael@epa.gov]; Simon, Karl [Simon.Karl@epa.gov]; Shelby, Michael [Shelby.Michael@epa.gov]
Subject: Update agenda for 3 PM with Karl
Attachments: WWEC Topics - REVISED (1 Feb 2017).docx; Comments on RFF Draft report 11317 (002)_(From_MShelby20170126)20170210d....docx; Draft report 11317 (002).docx; Project Ideas v3.docx; 2017.02.13 Proposal for Publishing GTM Monte Carlo Work.docx

All-

Here is the final agenda for 3 PM.

1. GTM monte carlo analysis (see attachment)
2. 321/Executive Order "Controlling Regulatory Costs"
3. EPA/Leiby Comments on RFF Energy Security Report (see attachments)
4. Hacking for X revisions (see attachment)
5. Invitation to speak at the DLA Energy Worldwide Conference (see also proposed list of speakers attached)

-Sharyn

Driving Innovation in Clean Transportation

Message

From: Wehrly, Linc [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=64E5F31CCB4841018441B3BF074842D0-WEHRLY, LINC]
Sent: 1/7/2021 12:50:19 PM
To: Caldwell, Jim [Caldwell.Jim@epa.gov]
Subject: RE: High-volume 2021 Gasoline Engine for Testing at SwRI
Attachments: 2021 Projected sales - sorted largest to smallest 2021-01-06.xlsx

Jim,

No. It is projected to be the Ex. 4 CBI best selling engine. I have attached a spreadsheet that Karen Danzeisen has pulled together with 2021 projected sales to help.

Linc

From: Caldwell, Jim <Caldwell.Jim@epa.gov>
Sent: Wednesday, January 06, 2021 4:16 PM
To: Wehrly, Linc <wehrly.linc@epa.gov>
Subject: High-volume 2021 Gasoline Engine for Testing at SwRI

Linc,

SwRI has proposed: **2021 Toyota Camry 2.5 L. Certified Engine Family/Test Group MTYXV02.5P3A**

Is this likely to be one of the Ex. 4 CBI selling engines for 2021?

Thanks, Jim

Model Yr	Mfr Name	Division	Carline
2021	Honda	Honda	CR-V AWD
2021	Subaru	Subaru	FORESTER AWD
2021	Toyota	TOYOTA	4RUNNER 4WD
2021	Toyota	TOYOTA	TACOMA 4WD
2021	Toyota	TOYOTA	COROLLA
2021	Honda	Honda	CR-V FWD
2021	Toyota	TOYOTA	RAV4 HYBRID AWD
2021	Subaru	Subaru	OUTBACK AWD
2021	Toyota	TOYOTA	CAMRY LE/SE
2021	Nissan	NISSAN	ROGUE AWD SV/SL/PLATINUM
2021	GM	Chevrolet	EQUINOX FWD
2021	FOMOCO	Ford	F150 PICKUP 4WD
2021	Toyota	TOYOTA	RAV4 AWD
2021	FCA US LLC	Jeep	Grand Cherokee 4X4
2021	Subaru	Subaru	CROSSTREK AWD
2021	FOMOCO	Ford	F150 PICKUP 4WD FFV
2021	Toyota	TOYOTA	RAV4
2021	Toyota	TOYOTA	HIGHLANDER AWD
2021	GM	Chevrolet	SILVERADO 4WD
2021	FOMOCO	Ford	F150 PICKUP 4WD
2021	Nissan	NISSAN	SENTRA
2021	Nissan	NISSAN	ROGUE FWD SV/SL/PLATINUM
2021	Honda	Honda	PILOT AWD
2021	Toyota	TOYOTA	TUNDRA 4WD
2021	FOMOCO	Ford	BRONCO SPORT 4WD
2021	GM	Chevrolet	MALIBU
2021	FCA US LLC	RAM	1500 4X4
2021	FOMOCO	Ford	EXPLORER RWD
2021	Honda	Honda	ODYSSEY FWD
2021	GM	Chevrolet	EQUINOX AWD
2021	Volkswagen Group of	Volkswagen	Jetta
2021	GM	Chevrolet	SILVERADO 4WD TRAILBOSS
2021	FCA US LLC	Jeep	Compass 4X4
2021	Honda	Honda	HR-V AWD
2021	MAZDA	MAZDA	CX-5 4WD
2021	FCA US LLC	Jeep	Wrangler 4dr 4X4
2021	Honda	Honda	ACCORD SPORT/TOURING
2021	Toyota	TOYOTA	COROLLA
2021	Toyota	TOYOTA	HIGHLANDER
2021	Hyundai	HYUNDAI MOTOR COMPANY	Elantra
2021	Honda	Honda	ACCORD
2021	Nissan	NISSAN	SENTRA
2021	FCA US LLC	RAM	1500 4X4
2021	Hyundai	HYUNDAI MOTOR COMPANY	Sonata
2021	FCA US LLC	Jeep	Gladiator 4X4
2021	Tesla	Tesla Motors	Model Y Long Range AWD

Testgroup	total Proj Sales
MHNXT01.5YLC	
MFJXJ02.5BUY	
MTYXT04.0M5S	
MTYXT03.5M5N	
MTYXV01.8M5B	
MHNXT01.5YLC	
MTYXT02.5P3N	
MFJXJ02.5BUY	
MTYXV02.5P3A	
MNSXT02.5RPA	
MGMXT01.5090	
MFMXT03.54JK	
MTYXJ02.5N4L	
MCRXT03.65P5	
MFJXJ02.5BUY	
MFMXT05.03DP	
MTYXJ02.5N4L	
MTYXT03.5M5M	
MGMXT05.3386	
MFMXT02.73JK	
MNSXV02.0RMA	
MNSXT02.5RPA	
MHNXV03.5NBC	
MTYXT05.7M5W	Ex. 4 CBI
MFMXT01.52X1	
MGMXV01.5010	
MCRXT05.75P1	
MFMXT02.33U1	
MHNXT03.5J4C	
MGMXT01.5090	
MVGAV01.4V3P	
MGMXT05.3386	
MCRXT02.45P1	
MHNXV01.8ECC	
MTKXT02.5CDA	
MCRXT03.65P7	
MHNXV01.53EB	
MTYXV02.0P3A	
MTYXT03.5M5M	
MHYXV02.0CE5	
MHNXV01.53EB	
MNSXV02.0RMB	
MCRXT05.75P0	
MHYXV02.5ER3	
MCRXT03.65P5	
MTSLV00.0L2Y	

2021 Toyota	TOYOTA	SIENNA
2021 Nissan	NISSAN	ALTIMA SV/SL
2021 GM	Chevrolet	TRAILBLAZER AWD
2021 Toyota	TOYOTA	TACOMA 2WD
2021 Nissan	NISSAN	KICKS
2021 FCA US LLC	Jeep	Cherokee 4X4
2021 Tesla	Tesla Motors	Model 3 Standard Range Plus RWD
2021 GM	Chevrolet	TRAILBLAZER FWD
2021 Kia	KIA MOTORS CORPORATION	Soul
2021 Subaru	Subaru	ASCENT LIMITED/TOURING AWD
2021 Toyota	TOYOTA	RAV4 AWD LE
2021 MAZDA	MAZDA	CX-5 2WD
2021 GM	Chevrolet	COLORADO 4WD
2021 GM	Chevrolet	TRAVERSE FWD
2021 Honda	Honda	CR-V AWD
2021 GM	Chevrolet	TAHOE 4WD
2021 GM	Buick	ENCORE GX FWD
2021 Honda	Honda	PILOT FWD
2021 FOMOCO	Ford	EXPLORER AWD
2021 Kia	KIA MOTORS CORPORATION	K5
2021 Volkswagen Group of	Volkswagen	Atlas 4Motion
2021 FOMOCO	Ford	F150 PICKUP 2WD
2021 GM	Chevrolet	SILVERADO 2WD
2021 FCA US LLC	Jeep	Wrangler 4dr 4X4
2021 Kia	KIA MOTORS CORPORATION	Telluride AWD
2021 Toyota	TOYOTA	VENZA AWD
2021 FOMOCO	Ford	RANGER 4WD
2021 Kia	KIA MOTORS CORPORATION	Forte
2021 FOMOCO	Ford	EDGE AWD
2021 MAZDA	MAZDA	CX-30 4WD
2021 Honda	Honda	HR-V FWD
2021 Honda	Honda	CIVIC 4Dr
2021 Nissan	NISSAN	ALTIMA SR
2021 Volkswagen Group of	Volkswagen	Tiguan 4Motion
2021 Toyota	LEXUS	RX 350 AWD
2021 FOMOCO	Ford	F150 PICKUP 4WD HEV
2021 GM	GMC	SIERRA 4WD
2021 Subaru	Subaru	IMPREZA 5-Door
2021 Tesla	Tesla Motors	Model 3 Long Range AWD
2021 GM	Chevrolet	TRAVERSE AWD
2021 Honda	Honda	CIVIC 4Dr
2021 FCA US LLC	Dodge	Charger
2021 Toyota	TOYOTA	C-HR
2021 Volkswagen Group of	Audi	Q3 quattro
2021 Volkswagen Group of	Volkswagen	Passat
2021 Nissan	NISSAN	VERSA
2021 GM	GMC	ACADIA AWD

MTYXT02.5P34
MNSXV02.5RPB
MGMXV01.3545
MTYXT03.5M5N
MNSXV01.6RNA
MCRXT03.25P0
MTSLV00.0L13
MGMXV01.3545
MKMXV02.0BE3
MFJXJ02.4CZA
MTYXJ02.5N4L
MTKXT02.5CDA
MGMXT03.6162
MGMXT03.6151
MHNXT02.0WMC
MGMXT05.3388
MGMXV01.3545
MHNXV03.5NBC
MFMXT03.03U2
MKMXV01.6DC5
MVGAT03.6VAS
MFMXT02.73JK
MGMXT05.3386
MCRXT02.05P4
MKMXT03.8ML5
MTYXT02.5P3N
MFMXT02.33ME
MKMXV02.0CE5
MFMXT02.02JU
MTKXV02.5CDA
MHNXV01.8ECC
MHNXV02.0DH3
MNSXV02.5RPB
MVGAJ02.0V3A
MTYXT03.5M5M
MFMXT03.51F1
MGMXT05.3386
MFJXJ02.5BUY
MTSLV00.0L23
MGMXT03.6151
MHNXV02.0CL3
MCRXV03.65P3
MTYXV02.0K6B
MVGAJ02.0A3T
MVGAJ02.0V3A
MNSXV01.6RNA
MGMXT03.6151

Ex. 4 CBI

2021 Toyota	TOYOTA	HIGHLANDER HYBRID AWD
2021 Subaru	Subaru	OUTBACK AWD
2021 Nissan	NISSAN	ROGUE SPORT AWD
2021 GM	Chevrolet	SUBURBAN 4WD
2021 Hyundai	HYUNDAI MOTOR COMPANY	Sonata
2021 FOMOCO	Ford	ECOSPORT AWD
2021 GM	Chevrolet	SILVERADO 4WD
2021 Volkswagen Group of	Audi	Q5
2021 Honda	Honda	ACCORD SPORT/TOURING
2021 FCA US LLC	Chrysler	Pacifica
2021 Nissan	NISSAN	SENTRA SR
2021 MAZDA	MAZDA	CX-30 2WD
2021 Hyundai	HYUNDAI MOTOR COMPANY	Santa Fe FWD
2021 GM	Chevrolet	CORVETTE
2021 Toyota	TOYOTA	CAMRY XLE/XSE
2021 FCA US LLC	Chrysler	Voyager
2021 Nissan	NISSAN	ROGUE AWD
2021 GM	Buick	ENCORE GX AWD
2021 FOMOCO	Ford	F150 PICKUP 2WD FFV
2021 Toyota	TOYOTA	TACOMA 2WD
2021 Honda	Honda	ACCORD
2021 Honda	Acura	RDX AWD
2021 Toyota	LEXUS	GX 460
2021 Toyota	LEXUS	RX 350
2021 Hyundai	HYUNDAI MOTOR COMPANY	Elantra
2021 FCA US LLC	Jeep	Renegade 4x4
2021 FOMOCO	Ford	ESCAPE FWD
2021 Toyota	TOYOTA	TUNDRA 2WD
2021 GM	GMC	TERRAIN AWD
2021 Hyundai	HYUNDAI MOTOR COMPANY	Palisade AWD
2021 Hyundai	HYUNDAI MOTOR COMPANY	Palisade FWD
2021 Subaru	Subaru	LEGACY
2021 FOMOCO	Ford	Transit Connect Van FWD
2021 FOMOCO	Ford	F150 PICKUP 2WD FFV
2021 GM	GMC	SIERRA 4WD
2021 Toyota	TOYOTA	CAMRY HYBRID SE/XLE/XSE
2021 Toyota	TOYOTA	PRIUS
2021 GM	Chevrolet	SILVERADO 4WD
2021 Nissan	NISSAN	ROGUE SPORT
2021 Honda	Honda	CIVIC 5DR
2021 GM	GMC	SIERRA 4WD
2021 FCA US LLC	Chrysler	300
2021 Volkswagen Group of	Volkswagen	Tiguan
2021 Nissan	NISSAN	ROGUE FWD
2021 Hyundai	HYUNDAI MOTOR COMPANY	Santa Fe AWD
2021 Toyota	TOYOTA	SIENNA AWD
2021 Honda	Honda	RIDGELINE AWD

MTYXT02.5P34
MFJXJ02.4CZA
MNSXV02.0PMA
MGMXT05.3388
MHYXV01.6EC5
MFMXT02.01B2
MGMXT02.7100
MVGAJ02.0A7G
MHNXV02.06EC
MCRXT03.65P5
MNSXV02.0RMA
MTKXV02.5CDA
MHYXT02.5MR3
MGMXV06.2091
MTYXV02.5P3A
MCRXT03.65P5
MNSXT02.5RPA
MGMXV01.3545
MFMXT05.03DP
MTYXT02.7M5P
MHNXV02.0BEB
MHNXT02.08VC
MTYXT04.6K6W
MTYXT03.5M5M
MHYXV02.0CE3
MCRXT02.45P1
MFMXT01.52X1
MTYXT05.7M5W
MGMXT01.5090
MHYXT03.8NL5
MHYXT03.8NL5
MFJXJ02.5BUY
MFMXT02.02NP
MFMXT03.33DU
MGMXT03.0351
MTYXV02.5P33
MTYXV01.8P33
MGMXT03.0351
MNSXV02.0PMA
MHNXV01.5GH2
MGMXT06.2377
MCRXV03.65P3
MVGAJ02.0V3A
MNSXT02.5RPA
MHYXT02.5MR3
MTYXT02.5P34
MHNXT03.5RSC

Ex. 4 CBI

2021 FOMOCO	Ford	ESCAPE AWD
2021 Toyota	LEXUS	NX 300
2021 FOMOCO	Ford	EXPLORER AWD
2021 Kia	KIA MOTORS CORPORATION	Forte
2021 FOMOCO	Ford	RANGER 2WD
2021 FOMOCO	Ford	EDGE FWD
2021 GM	Cadillac	ESCALADE 4WD
2021 Nissan	NISSAN	MURANO AWD
2021 Honda	Honda	CIVIC 5DR
2021 FCA US LLC	Jeep	Grand Cherokee 4X2
2021 FCA US LLC	Jeep	Cherokee 4X4
2021 FOMOCO	Ford	ECOSPORT FWD
2021 Kia	KIA MOTORS CORPORATION	Telluride FWD
2021 FCA US LLC	Dodge	Durango AWD
2021 FCA US LLC	RAM	1500 Classic 4X4
2021 Kia	KIA MOTORS CORPORATION	Sportage FWD
2021 GM	Chevrolet	SILVERADO 4WD TRAILBOSS
2021 Toyota	LEXUS	NX 300 AWD
2021 BMW	BMW	X3 xDrive30i
2021 MAZDA	MAZDA	CX-5 4WD
2021 BMW	BMW	X5 xDrive40i
2021 FOMOCO	Ford	EXPEDITION MAX 4WD
2021 Honda	Honda	PASSPORT AWD
2021 FCA US LLC	Jeep	Compass 4X2
2021 FOMOCO	Ford	EXPEDITION 4WD
2021 FCA US LLC	Jeep	Renegade 4x2
2021 Nissan	NISSAN	ALTIMA AWD
2021 GM	GMC	TERRAIN FWD
2021 GM	GMC	YUKON 4WD
2021 GM	Chevrolet	TAHOE 2WD
2021 Nissan	NISSAN	ALTIMA
2021 GM	GMC	ACADIA FWD
2021 Kia	KIA MOTORS CORPORATION	Sportage AWD
2021 Nissan	NISSAN	SENTRA SR
2021 GM	Chevrolet	COLORADO 2WD
2021 GM	Cadillac	XT5 AWD
2021 BMW	BMW	X7 xDrive40i
2021 GM	Chevrolet	BLAZER FWD
2021 GM	Chevrolet	SILVERADO 2WD
2021 Honda	Honda	INSIGHT
2021 MAZDA	MAZDA	MAZDA3 4-Door 2WD
2021 GM	Chevrolet	BLAZER AWD
2021 Nissan	NISSAN	MURANO FWD
2021 Honda	Acura	RDX FWD
2021 GM	Cadillac	XT6 AWD
2021 Volvo	Volvo Cars of North America, LLC	XC40 AWD
2021 Nissan	INFINITI	QX50 AWD

MFMXT01.52X1
MTYXT02.0K6M
MFMXT02.33U1
MKMXV02.0CE3
MFMXT02.33ME
MFMXT02.02JU
MGMXT06.2375
MNSXV03.5P7C
MHNXV01.52L2
MCRXT03.65P5
MCRXT02.45P1
MFMXT01.01B7
MKMXT03.8ML5
MCRXT03.65P5
MCRXT05.75P2
MKMXT02.4HH5
MGMXT06.2377
MTYXT02.0K6M
MBMXJ02.0B4X
MTKXT02.5EGA
MBMXT03.0G0X
MFMXT03.54HF
MHNXV03.5NBC
MCRXT02.45P1
MFMXT03.54HF
MCRXT02.45P1
MNSXV02.5RPB
MGMXT01.5090
MGMXT06.2375
MGMXT05.3388
MNSXV02.5RPB
MGMXT03.6151
MKMXT02.4HH3
MNSXV02.0RMB
MGMXT03.6162
MGMXT03.6151
MBMXT03.0G0X
MGMXT03.6151
MGMXT04.3186
MHNXV01.5CEB
MTKXV02.5CDA
MGMXT03.6151
MNSXV03.5P7C
MHNXT02.08VC
MGMXT03.6151
MVVXJ02.0U70
MNSXT02.0AVA

Ex. 4 CBI

2021	Mercedes-Benz	Mercedes-Benz	GLC 300 4MATIC
2021	GM	GMC	YUKON XL 4WD
2021	Toyota	TOYOTA	RAV4 PRIME AWD
2021	Toyota	TOYOTA	HIGHLANDER HYBRID
2021	FCA US LLC	RAM	1500 Classic 4X2
2021	FOMOCO	Ford	EXPEDITION 2WD
2021	Mercedes-Benz	Mercedes-Benz	GLE 350 4MATIC
2021	FCA US LLC	Jeep	Cherokee FWD
2021	Kia	KIA MOTORS CORPORATION	Sorento FWD
2021	FCA US LLC	Chrysler	Pacifica Hybrid
2021	MAZDA	MAZDA	CX-9 4WD
2021	Hyundai	HYUNDAI MOTOR COMPANY	Tucson AWD
2021	Nissan	NISSAN	ALTIMA AWD SR/PLATINUM
2021	FOMOCO	Ford	BRONCO SPORT 4WD
2021	FCA US LLC	Jeep	Cherokee FWD
2021	FCA US LLC	Chrysler	Pacifica AWD
2021	Honda	Honda	Clarity
2021	Subaru	Subaru	ASCENT AWD
2021	BMW	BMW	X3 sDrive30i
2021	GM	Chevrolet	SILVERADO 2WD
2021	FCA US LLC	RAM	1500 4X4
2021	FCA US LLC	Jeep	Cherokee Trailhawk 4X4
2021	Kia	KIA MOTORS CORPORATION	Seltos AWD
2021	GM	Chevrolet	SILVERADO 4WD
2021	Toyota	TOYOTA	4RUNNER 2WD
2021	Hyundai	HYUNDAI MOTOR COMPANY	Tucson FWD
2021	GM	GMC	CANYON 4WD
2021	GM	GMC	SIERRA 2WD
2021	FOMOCO	Ford	F150 PICKUP 4WD FFV
2021	Hyundai	HYUNDAI MOTOR COMPANY	Accent
2021	GM	GMC	SIERRA 4WD AT4
2021	Toyota	TOYOTA	HIGHLANDER HYBRID AWD LTD/PLAT
2021	GM	GMC	SIERRA 4WD AT4
2021	Subaru	Subaru	WRX
2021	Nissan	INFINITI	QX50
2021	FOMOCO	Ford	F150 PICKUP 4WD
2021	Hyundai	HYUNDAI MOTOR COMPANY	Venue
2021	Nissan	NISSAN	ALTIMA SR/PLATINUM
2021	Kia	KIA MOTORS CORPORATION	Sorento AWD
2021	Toyota	LEXUS	ES 350
2021	Toyota	TOYOTA	CAMRY AWD XLE/XSE
2021	Kia	KIA MOTORS CORPORATION	Rio
2021	Volvo	Volvo Cars of North America, LLC	XC90 AWD
2021	Volkswagen Group of	Volkswagen	Atlas
2021	Hyundai	HYUNDAI MOTOR COMPANY	Santa Fe AWD
2021	Toyota	TOYOTA	COROLLA HATCHBACK
2021	GM	Buick	ENVISION FWD

MMBXJ02.0U3A
MGMXT06.2375
MTYXT02.5P33
MTYXT02.5P34
MCRXT05.75P2
MFMXT03.54HF
MMBXT02.0U3A
MCRXT03.25P0
MKMXT02.5JR5
MCRXT03.65P6
MTKXT02.5EGA
MHYXV02.0LF5
MNSXV02.5RPB
MFMXT02.02Y1
MCRXT02.45P1
MCRXT03.65P5
MHNXV01.5DFB
MFJXJ02.4CZA
MBMXJ02.0B4X
MGMXT02.7100
MCRXT03.65P7
MCRXT03.25P0
MKMXT02.0NE5
MGMXT06.2377
MTYXT04.0M5S
MHYXV02.0LF3
MGMXT03.6162
MGMXT05.3386
MFMXT03.33DU
MHYXV01.6AB6
MGMXT05.3386
MTYXT02.5P34
MGMXT03.0351
MFJXV02.0FPT
MNSXT02.0AVA
MFMXT03.03DZ
MHYXV01.6SB5
MNSXV02.0AVA
MKMXT02.5JP5
MTYXV03.5M5B
MTYXJ02.5N4L
MKMXV01.6AB6
MVVXJ02.0S30
MVGAT03.6VAS
MHYXT02.5MP5
MTYXV02.0P3A
MGMXT02.0500

Ex. 4 CBI

2021 Toyota	TOYOTA	COROLLA HYBRID
2021 BMW	BMW	228i xDrive Gran Coupe
2021 Volvo	Volvo Cars of North America, LLC	XC60 AWD
2021 Jaguar Land Rover L	Land Rover	Range Rover Sport MHEV
2021 GM	Chevrolet	SPARK
2021 Mercedes-Benz	Mercedes-Benz	GLB 250 4MATIC
2021 Subaru	Subaru	IMPREZA 4-Door
2021 MAZDA	MAZDA	CX-30 4WD
2021 Toyota	LEXUS	NX 300 AWD F SPORT
2021 Hyundai	HYUNDAI MOTOR COMPANY	Tucson AWD
2021 FOMOCO	Ford	MUSTANG
2021 GM	Cadillac	XT5 FWD
2021 GM	Cadillac	XT4 AWD
2021 Nissan	NISSAN	NV200 CARGO VAN
2021 Volkswagen Group of	Audi	A4 S line quattro
2021 GM	Cadillac	XT4 FWD
2021 GM	GMC	SIERRA 4WD AT4
2021 FCA US LLC	RAM	1500 4X4
2021 GM	Chevrolet	SUBURBAN 2WD
2021 FOMOCO	Ford	MUSTANG MACH-E AWD EXTENDED
2021 GM	Buick	ENCLAVE FWD
2021 Honda	Acura	TLX FWD
2021 Mercedes-Benz	Mercedes-Benz	GLA 250 4MATIC
2021 Toyota	TOYOTA	CAMRY AWD LE/SE
2021 FCA US LLC	RAM	1500 Classic 4X4
2021 Hyundai	HYUNDAI MOTOR COMPANY	Tucson FWD
2021 GM	Chevrolet	COLORADO 2WD
2021 Volkswagen Group of	Audi	Q7
2021 Volkswagen Group of	Audi	Q7
2021 FOMOCO	Ford	ESCAPE AWD
2021 GM	Buick	ENCLAVE AWD
2021 Toyota	LEXUS	RX 450h AWD
2021 Nissan	NISSAN	MAXIMA
2021 GM	Buick	ENVISION AWD
2021 GM	GMC	YUKON 4WD
2021 BMW	BMW	X5 sDrive40i
2021 Volkswagen Group of	Volkswagen	Atlas 4Motion 2.0L
2021 FOMOCO	Ford	MUSTANG
2021 Mercedes-Benz	Mercedes-Benz	GLC 300
2021 Honda	Honda	ACCORD SPORT/TOURING
2021 FOMOCO	Ford	ESCAPE AWD HEV
2021 Mercedes-Benz	Mercedes-Benz	GLE 350
2021 MAZDA	MAZDA	MAZDA3 5-Door 2WD
2021 Tesla	Tesla Motors	Model Y Performance AWD
2021 Volkswagen Group of	Volkswagen	GTI
2021 Volkswagen Group of	Audi	e-tron
2021 FOMOCO	Ford	EXPEDITION MAX 2WD

MTYXV01.8P33
MBMXJ02.0B4X
MVVXJ02.0U70
MJLXT03.0HTR
MGMXV01.4050
MMBXJ02.0U3B
MFJXJ02.5BUY
MTKXV02.5FFA
MTYXT02.0K6M
MHYXV02.4LH5
MFMXV05.0VKN
MGMXT03.6151
MGMXT02.0500
MNSXT02.0N2A
MVGAJ02.0A7G
MGMXT02.0500
MGMXT06.2377
MCRXT03.05PW
MGMXT05.3388
MFMXV00.0B4A
MGMXT03.6151
MHNXV02.0AEC
MMBXJ02.0U3B
MTYXJ02.5N4L
MCRXT03.65P1
MHYXV02.4LH3
MGMXT02.5200
MVGAT02.0AA7
MVGAT03.0N7M
MFMXT02.02Y1
MGMXT03.6151
MTYXT03.5P34
MNSXV03.5N7B
MGMXT02.0500
MGMXT05.3388
MBMXT03.0G0X
MVGAT02.0VAA
MFMXV02.3VJY
MMBXJ02.0U3A
MHNXV02.0BEB
MFMXT02.52F1
MMBXT02.0U3A
MTKXV02.5CDA
MTSLV00.0L2Y
MVGAV02.0V3T
MVGAT00.0AZE
MFMXT03.54HF

Ex. 4 CBI

2021 Kia	KIA MOTORS CORPORATION	Sportage AWD
2021 Kia	KIA MOTORS CORPORATION	K5 AWD
2021 FOMOCO	Lincoln	AVIATOR AWD
2021 Toyota	TOYOTA	PRIUS PRIME
2021 BMW	BMW	X1 xDrive28i
2021 Honda	Honda	PASSPORT FWD
2021 Kia	KIA MOTORS CORPORATION	Seltos AWD
2021 Toyota	TOYOTA	PRIUS AWD
2021 GM	Cadillac	XT6 FWD
2021 GM	Chevrolet	CAMARO
2021 GM	Chevrolet	BLAZER FWD
2021 FCA US LLC	Dodge	Durango RWD
2021 FCA US LLC	RAM	1500 4X2
2021 Toyota	LEXUS	ES 300h
2021 Nissan	NISSAN	TITAN 4WD
2021 BMW	BMW	330i
2021 FOMOCO	Ford	F150 PICKUP 2WD
2021 GM	Chevrolet	TAHOE 4WD
2021 Mitsubishi Motors Co	Mitsubishi Motors Corporation	Outlander Sport 4WD
2021 FOMOCO	Lincoln	NAVIGATOR 4WD
2021 FCA US LLC	Dodge	Challenger
2021 Honda	Acura	TLX AWD
2021 GM	Chevrolet	SILVERADO 4WD
2021 Kia	KIA MOTORS CORPORATION	Sorento AWD
2021 Nissan	NISSAN	LEAF SV/SL
2021 Tesla	Tesla Motors	Model 3 Performance AWD
2021 Toyota	TOYOTA	COROLLA XSE
2021 Jaguar Land Rover L	Land Rover	Range Rover MHEV
2021 FOMOCO	Lincoln	CORSAIR FWD
2021 FCA US LLC	RAM	1500 TRX 4x4
2021 FOMOCO	Ford	ESCAPE FWD HEV
2021 Volkswagen Group of	Volkswagen	Atlas
2021 Mercedes-Benz	Mercedes-Benz	GLB 250
2021 GM	Chevrolet	TRAX AWD
2021 MAZDA	MAZDA	CX-9 2WD
2021 Volkswagen Group of	Volkswagen	ID.4 Pro S
2021 Honda	Honda	CIVIC 4Dr
2021 Hyundai	HYUNDAI MOTOR COMPANY	Kona AWD
2021 Nissan	INFINITI	Q50 AWD
2021 Kia	KIA MOTORS CORPORATION	Seltos FWD
2021 FCA US LLC	Jeep	Grand Cherokee 4X4
2021 FOMOCO	Lincoln	CORSAIR AWD
2021 Mercedes-Benz	Mercedes-Benz	AMG GLE 53 4MATIC+ (coupe)
2021 Honda	Acura	ILX
2021 GM	Buick	ENCORE AWD
2021 GM	Chevrolet	CAMARO
2021 FCA US LLC	Jeep	Wrangler 2dr 4X4

MKMXT02.4HH5	
MKMXV01.6DC5	
MFMXT03.03U2	
MTYXV01.8P35	
MBMXJ02.0B4X	
MHNXV03.5NBC	
MKMXT01.6NC5	
MTYXV01.8P33	
MGMXT03.6151	
MGMXV06.2090	
MGMXT02.5201	
MCRXT03.65P5	
MCRXT05.75P1	
MTYXV02.5P33	
MNSXT05.6P9A	
MBMXJ02.0B4X	
MFMXT03.54JK	
MGMXT06.2375	
MMTXT02.4G5P	
MFMXT03.54HF	
MCRXV03.65P3	
MHNXV02.0AEC	
MGMXT04.3186	
MKMXT02.5JR5	**Ex. 4 CBI**
MNSXV0000TS3	
MTSLV00.0L23	
MTYXV02.0P3A	
MJLXT03.0HTR	
MFMXT02.02Y1	
MCRXT06.25P1	
MFMXT02.52F1	
MVGAT02.0VAA	
MMBXJ02.0U3B	
MGMXV01.4001	
MTKXT02.5EGA	
MVGAT00.0VZR	
MHNXV01.5GH2	
MHYXV02.0KE5	
MNSXV03.0NHA	
MKMXT02.0NE5	
MCRXT05.75P2	
MFMXT02.02Y1	
MMBXT03.0HY2	
MHNXV02.4KH3	
MGMXV01.4001	
MGMXV02.0031	
MCRXT02.05P4	

2021	Volkswagen Group of	Audi	Q8
2021	Toyota	TOYOTA	AVALON
2021	Nissan	NISSAN	ARMADA 4WD
2021	GM	Cadillac	XT5 FWD
2021	Mitsubishi Motors Co	Mitsubishi Motors Corporation	Outlander Sport 2WD
2021	FCA US LLC	Dodge	Charger
2021	GM	GMC	YUKON XL 4WD
2021	FCA US LLC	RAM	1500 Classic 4X2
2021	Nissan	NISSAN	ARMADA 2WD
2021	FCA US LLC	Jeep	Wrangler Rubic 4dr EcoDiesel 4x4
2021	Mercedes-Benz	Mercedes-Benz	Metris (Cargo Van)
2021	FCA US LLC	Dodge	Challenger
2021	Mercedes-Benz	Mercedes-Benz	GLA 250
2021	GM	Chevrolet	COLORADO ZR2 4WD
2021	Honda	Honda	INSIGHT TOURING
2021	Nissan	NISSAN	TITAN 2WD
2021	FCA US LLC	Dodge	Charger
2021	Jaguar Land Rover L	Land Rover	Discovery Sport
2021	Mercedes-Benz	Mercedes-Benz	A 220
2021	FCA US LLC	Dodge	Challenger
2021	GM	Chevrolet	TRAX AWD
2021	Porsche	Porsche	Macan
2021	GM	Buick	ENCORE FWD
2021	FCA US LLC	Dodge	Challenger Widebody
2021	BMW	BMW	330i xDrive
2021	Mercedes-Benz	Mercedes-Benz	E 350
2021	Volkswagen Group of	Audi	A4 quattro
2021	Hyundai	HYUNDAI MOTOR COMPANY	Sonata
2021	GM	Cadillac	ESCALADE 2WD
2021	Mercedes-Benz	Mercedes-Benz	C 300
2021	Toyota	LEXUS	NX 300h AWD
2021	GM	Chevrolet	TRAX FWD
2021	Toyota	TOYOTA	CAMRY XSE
2021	Toyota	LEXUS	ES 250 AWD
2021	FCA US LLC	Dodge	Charger Widebody
2021	Hyundai	HYUNDAI MOTOR COMPANY	Kona FWD
2021	Volvo	Volvo Cars of North America, LLC	S60 FWD
2021	GM	Chevrolet	BOLT EV
2021	GM	GMC	YUKON 2WD
2021	GM	Cadillac	CT5
2021	FOMOCO	Ford	MUSTANG CONVERTIBLE
2021	FCA US LLC	Dodge	Durango AWD
2021	Nissan	NISSAN	FRONTIER 4WD
2021	Kia	KIA MOTORS CORPORATION	Sorento FWD
2021	Nissan	INFINITI	Q50
2021	Honda	Honda	CIVIC 4Dr
2021	FOMOCO	Ford	EXPLORER HEV AWD

MVGAT03.0N7M
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MCRXV05.75P3
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MMBXV02.0U3C
MCRXV05.75P3
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MGMXV01.4099
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MMBXJ02.0U3A
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MTYXT02.5P3M
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MTYXJ02.5N4L
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MGMXV02.0041
MFMXV02.3VJY
MCRXT05.75P0
MNSXT03.8PRA
MKMXT02.5JP5
MNSXV03.0NHA
MHNXV01.52L2
MFMXT03.33F1

Ex. 4 CBI

2021 Kia	KIA MOTORS CORPORATION	Sportage FWD
2021 Toyota	LEXUS	IS 300
2021 Jaguar Land Rover L	Land Rover	Evoque
2021 Toyota	TOYOTA	TACOMA 4WD
2021 MAZDA	MAZDA	MAZDA6
2021 Toyota	LEXUS	IS 350
2021 Kia	KIA MOTORS CORPORATION	Sorento Hybrid
2021 Volvo	Polestar Automotive USA Inc	Polestar 2
2021 Volvo	Volvo Cars of North America, LLC	XC60 AWD
2021 Porsche	Porsche	Cayenne
2021 Toyota	LEXUS	UX 250h AWD
2021 Nissan	NISSAN	LEAF
2021 MAZDA	MAZDA	MAZDA3 4-Door 4WD
2021 Nissan	NISSAN	FRONTIER 2WD
2021 MAZDA	MAZDA	MX-5
2021 Hyundai	HYUNDAI MOTOR COMPANY	Kona Electric
2021 FOMOCO	Lincoln	NAUTILUS FWD
2021 Honda	Honda	RIDGELINE FWD
2021 Toyota	TOYOTA	TACOMA 4WD D-CAB MT TRD-ORP/PRO
2021 GM	GMC	ACADIA FWD
2021 Mercedes-Benz	Mercedes-Benz	C 300 4MATIC
2021 Honda	Acura	RDX AWD A-SPEC
2021 FOMOCO	Ford	Transit Connect Wagon LWB FWD
2021 Toyota	TOYOTA	CAMRY HYBRID LE
2021 Kia	KIA MOTORS CORPORATION	Soul Eco dynamics
2021 FOMOCO	Ford	TRANSIT CONNECT USPS
2021 BMW	BMW	X3 M40i
2021 FOMOCO	Ford	EDGE AWD
2021 Toyota	TOYOTA	SEQUOIA 4WD
2021 Volkswagen Group of	Audi	A5 Sportback S line quattro
2021 Hyundai	GENESIS	GV80 AWD
2021 FCA US LLC	RAM	1500 4X2
2021 Volkswagen Group of	Volkswagen	Atlas Cross Sport
2021 FCA US LLC	Jeep	Renegade 4x4
2021 GM	GMC	CANYON 2WD
2021 Nissan	INFINITI	QX80 4WD
2021 Volkswagen Group of	Audi	Q5
2021 Kia	KIA MOTORS CORPORATION	Sedona
2021 GM	Cadillac	CT5 AWD
2021 Volvo	Volvo Cars of North America, LLC	XC90 AWD
2021 FCA US LLC	Jeep	Wrangler 4dr EcoDiesel 4x4
2021 Volkswagen Group of	Volkswagen	Jetta
2021 Hyundai	HYUNDAI MOTOR COMPANY	Elantra
2021 FOMOCO	Lincoln	NAUTILUS AWD
2021 Toyota	TOYOTA	AVALON HYBRID
2021 Porsche	Porsche	Macan S
2021 FOMOCO	Lincoln	NAUTILUS AWD

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MJLXT02.0RTV
MTYXT02.7M5P
MTKXV02.5FFA
MTYXV03.5M5A
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MVVXJ02.0S30
MPRXT03.0CV6
MTYXV02.0P3B
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MTKXV02.5CDA
MNSXT03.8PRA
MTKXV02.0FFA
MHYXV00.0K31
MFMXT02.02JU
MHNXT03.5RSC
MTYXT03.5M5N
MGMXT02.5201
MMBXJ02.0U3A
MHNXT02.09VC
MFMXT02.02NP
MTYXV02.5P33
MKMXV02.0BE3
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MBMXJ03.0B5X
MFMXT02.72JQ
MTYXT05.7M5W
MVGAJ02.0A7G
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MCRXT05.75P0
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MGMXT03.6162
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MVGAJ02.0A3P
MKMXT03.3KJ5
MGMXV02.0041
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MFMXT02.02JU
MTYXV02.5P33
MPRXT03.0CV6
MFMXT02.72JQ

Ex. 4 CBI

2021	GM	Chevrolet	SILVERADO 2WD
2021	GM	Chevrolet	SILVERADO 4WD TRAILBOSS
2021	GM	Chevrolet	TAHOE 2WD
2021	BMW	BMW	530i xDrive
2021	FCA US LLC	Jeep	Wrangler 2dr 4X4
2021	Subaru	Subaru	WRX
2021	Hyundai	HYUNDAI MOTOR COMPANY	Ioniq
2021	GM	GMC	ACADIA AWD
2021	MAZDA	MAZDA	MAZDA6
2021	Nissan	NISSAN	MURANO AWD
2021	FCA US LLC	RAM	1500 4X2
2021	Toyota	LEXUS	RX 350 L AWD
2021	GM	Chevrolet	TAHOE 4WD
2021	Volvo	Volvo Cars of North America, LLC	S60 AWD
2021	Mercedes-Benz	Mercedes-Benz	A 220 4MATIC
2021	FOMOCO	Ford	RANGER TREMOR 4WD
2021	FCA US LLC	Dodge	Charger SRT Widebody
2021	Hyundai	HYUNDAI MOTOR COMPANY	Kona AWD
2021	Mercedes-Benz	Mercedes-Benz	E 350 4MATIC
2021	BMW	BMW	X1 sDrive28i
2021	Volvo	Volvo Cars of North America, LLC	XC60 FWD
2021	Toyota	TOYOTA	RAV4 AWD TRD OFFROAD
2021	Hyundai	GENESIS	G70 RWD
2021	Kia	KIA MOTORS CORPORATION	Forte
2021	BMW	BMW	530i
2021	Volkswagen Group of	Volkswagen	Atlas Cross Sport 4Motion
2021	Hyundai	HYUNDAI MOTOR COMPANY	Santa Fe Hybrid
2021	Mercedes-Benz	Mercedes-Benz	GLE 450 4MATIC
2021	Subaru	Subaru	IMPREZA 5-Door SPORT
2021	Toyota	LEXUS	UX 200
2021	GM	Chevrolet	SUBURBAN 4WD
2021	GM	Chevrolet	CAMARO
2021	BMW	TOYOTA	Supra 3.0
2021	FOMOCO	Ford	EXPLORER RWD
2021	GM	Buick	ENCORE FWD
2021	GM	Cadillac	CT4
2021	MAZDA	MAZDA	MAZDA3 5-Door 4WD
2021	Volvo	Volvo Cars of North America, LLC	XC90 AWD
2021	Toyota	LEXUS	LX 570
2021	GM	Chevrolet	TRAX FWD
2021	GM	GMC	YUKON 2WD
2021	Honda	Acura	RDX FWD A-SPEC
2021	FOMOCO	Ford	MUSTANG MACH-E RWD EXTENDED
2021	Toyota	LEXUS	IS 300 AWD
2021	Toyota	LEXUS	IS 350 AWD
2021	BMW	BMW	X4 xDrive30i
2021	BMW	BMW	X6 xDrive40i

MGMXT03.0352
MGMXT04.3186
MGMXT06.2375
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MTKXV02.5CDA
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MCRXT03.65P7
MTYXT03.5M5M
MGMXT03.0353
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MFMXT02.33MC
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MTYXV03.5M5A
MTYXV03.5M5A
MBMXJ02.0B4X
MBMXT03.0G0X

Ex. 4 CBI

2021 Nissan	NISSAN	TITAN 4WD PRO-4X
2021 FCA US LLC	Jeep	Renegade Trailhawk 4x4
2021 Hyundai	HYUNDAI MOTOR COMPANY	Kona FWD
2021 FCA US LLC	Jeep	Wrangler 4dr 4X4
2021 Jaguar Land Rover L	Land Rover	Range Rover
2021 Kia	KIA MOTORS CORPORATION	Forte FE
2021 Honda	Acura	TLX AWD A-SPEC
2021 Hyundai	HYUNDAI MOTOR COMPANY	Santa Fe FWD
2021 GM	GMC	SIERRA 4WD
2021 Toyota	LEXUS	RX 350 L
2021 Honda	Honda	CIVIC 5DR
2021 GM	Chevrolet	MALIBU
2021 FCA US LLC	ALFA ROMEO	Stelvio AWD
2021 Nissan	NISSAN	MURANO FWD
2021 FOMOCO	Ford	MUSTANG MACH-E RWD
2021 Volvo	Volvo Cars of North America, LLC	V60 CC AWD
2021 Toyota	TOYOTA	AVALON XLE
2021 Volkswagen Group of	Volkswagen	Atlas Cross Sport
2021 Toyota	TOYOTA	COROLLA HATCHBACK XSE
2021 FCA US LLC	Jeep	Cherokee 4X4
2021 FCA US LLC	RAM	1500 4X2
2021 Toyota	TOYOTA	AVALON AWD
2021 Nissan	INFINITI	QX80 2WD
2021 Jaguar Land Rover L	Land Rover	Range Rover Velar
2021 FOMOCO	Ford	MUSTANG MACH 1
2021 Toyota	TOYOTA	COROLLA XLE
2021 BMW	BMW	X5 M50i
2021 Jaguar Land Rover L	Land Rover	Range Rover Sport
2021 Mitsubishi Motors Co	Mitsubishi Motors Corporation	MIRAGE
2021 FOMOCO	Ford	MUSTANG MACH-E AWD
2021 FOMOCO	Ford	EXPLORER HEV RWD
2021 GM	Chevrolet	COLORADO 4WD
2021 Hyundai	HYUNDAI MOTOR COMPANY	Sonata Hybrid
2021 Volvo	Volvo Cars of North America, LLC	XC60 AWD
2021 GM	GMC	YUKON XL 2WD
2021 Volkswagen Group of	Audi	A6 quattro
2021 FOMOCO	Lincoln	CORSAIR AWD
2021 Toyota	TOYOTA	PRIUS Eco
2021 FOMOCO	Ford	F150 PICKUP 2WD HEV
2021 GM	Cadillac	CT4 AWD
2021 Mercedes-Benz	Mercedes-Benz	AMG G 63
2021 Jaguar Land Rover L	Land Rover	Discovery MHEV
2021 Mercedes-Benz	Mercedes-Benz	AMG GLE 53 4MATIC+
2021 Jaguar Land Rover L	Jaguar	F-PACE
2021 Toyota	LEXUS	ES 350 F SPORT
2021 BMW	BMW	540i
2021 GM	Cadillac	XT5 AWD

MNSXT05.6P9A
MCRXT01.35P0
MHYXV01.6KC5
MCRXT03.65P5
MJLXT05.0FSN
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MHNXV02.0AEC
MHYXT02.5MP5
MGMXT02.7100
MTYXT03.5M5M
MHNXV02.01BM
MGMXV02.0031
MCRXJ02.05P2
MNSXV03.5P7D
MFMXV00.0B3R
MVVXJ02.0U70
MTYXV03.5M5B
MVGAT02.0VAA
MTYXV02.0P3A
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MCRXT03.05PW
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MJLXJ02.0RTX
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MJLXT03.0HTR
MMBXT03.0HY2
MJLXJ02.0RTX
MTYXV03.5M5B
MBMXV03.0G2X
MGMXT02.0500

Ex. 4 CBI

2021	BMW	BMW	430i Coupe
2021	Mitsubishi Motors Co	Mitsubishi Motors Corporation	MIRAGE G4
2021	Maserati	MASERATI	LEVANTE
2021	GM	Buick	ENCORE AWD
2021	GM	GMC	YUKON 4WD
2021	Hyundai	GENESIS	G80 RWD
2021	Hyundai	HYUNDAI MOTOR COMPANY	Santa Fe Hybrid Blue
2021	Volkswagen Group of	Audi	SQ7
2021	FOMOCO	Lincoln	AVIATOR AWD PHEV
2021	Subaru	Subaru	IMPREZA 4-Door SPORT
2021	Volkswagen Group of	Audi	SQ5
2021	GM	GMC	SIERRA 2WD
2021	Toyota	TOYOTA	MIRAI XLE
2021	BMW	BMW	X5 xDrive45e
2021	BMW	BMW	X7 M50i
2021	Toyota	LEXUS	LS 500
2021	FOMOCO	Ford	TRANSIT T150 WAGON 2WD FFV
2021	Hyundai	GENESIS	G70 AWD
2021	Kia	KIA MOTORS CORPORATION	Soul
2021	BMW	BMW	M440i xDrive Coupe
2021	BMW	BMW	540i xDrive
2021	Jaguar Land Rover L	Jaguar	F-PACE P340 MHEV
2021	Mercedes-Benz	Mercedes-Benz	CLA 250
2021	FCA US LLC	Dodge	Durango RWD
2021	Honda	Acura	TLX FWD A-SPEC
2021	FCA US LLC	Jeep	Gladiator EcoDiesel 4x4
2021	MAZDA	MAZDA	MAZDA3 4-Door 4WD
2021	Subaru	Subaru	CROSSTREK HYBRID AWD
2021	GM	GMC	ACADIA FWD
2021	Volkswagen Group of	Audi	S5 Sportback
2021	MAZDA	MAZDA	CX-5 2WD
2021	GM	GMC	SIERRA 2WD
2021	GM	GMC	YUKON XL 2WD
2021	Volvo	Volvo Cars of North America, LLC	S60 AWD
2021	GM	Chevrolet	TAHOE 2WD
2021	Volkswagen Group of	Audi	A7 quattro
2021	Hyundai	GENESIS	G70 RWD
2021	GM	Chevrolet	COLORADO 4WD
2021	FOMOCO	Ford	SHELBY GT500 MUSTANG
2021	BMW	BMW	740i
2021	BMW	Mini	COOPER S HARDTOP 4 DOOR
2021	BMW	BMW	330e
2021	Mercedes-Benz	Mercedes-Benz	GLC 300 4MATIC (Coupe)
2021	GM	GMC	SIERRA 2WD
2021	Hyundai	HYUNDAI MOTOR COMPANY	Ioniq Blue
2021	BMW	BMW	M340i
2021	Toyota	LEXUS	LC 500 CONVERTIBLE

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MMAXJ03.0DFI
MGMXV01.4099
MGMXT03.0353
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MFMXT03.03P1
MFJXJ02.5BUY
MVGAJ03.0N7F
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MTYXV03.5M5C
MFMXT03.55HM
MHYXV02.0GG6
MKMXV01.6BC5
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MBMXV03.0G2X
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MMBXV02.0U3C
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MCRXT03.05PW
MTKXV02.5FFA
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MTYXV05.0M5A

Ex. 4 CBI

2021	Mercedes-Benz	Mercedes-Benz	G 550
2021	FCA US LLC	Jeep	Gladiator Rubicon EcoDiesel 4x4
2021	BMW	BMW	228i Gran Coupe
2021	Kia	KIA MOTORS CORPORATION	Sportage AWD
2021	Kia	KIA MOTORS CORPORATION	K5
2021	FOMOCO	Lincoln	AVIATOR RWD
2021	Mercedes-Benz	Mercedes-Benz	E 450 4MATIC
2021	Toyota	LEXUS	LS 500 AWD
2021	BMW	BMW	330e xDrive
2021	GM	Chevrolet	BLAZER AWD
2021	Subaru	Subaru	LEGACY
2021	BMW	BMW	M340i xDrive
2021	Volvo	Volvo Cars of North America, LLC	XC40 FWD
2021	Hyundai	HYUNDAI MOTOR COMPANY	Elantra Hybrid
2021	Kia	KIA MOTORS CORPORATION	Niro
2021	BMW	Mini	COOPER HARDTOP 4 DOOR
2021	Volkswagen Group of	Volkswagen	Arteon
2021	Volkswagen Group of	Volkswagen	Arteon 4Motion
2021	BMW	BMW	430i xDrive Coupe
2021	Volkswagen Group of	Audi	A5 Cabriolet quattro
2021	FCA US LLC	RAM	Promaster City
2021	Volkswagen Group of	Volkswagen	Golf
2021	MAZDA	MAZDA	MAZDA3 5-Door 4WD
2021	Hyundai	GENESIS	G80 AWD
2021	Hyundai	GENESIS	GV80 AWD
2021	FCA US LLC	Dodge	Charger AWD
2021	Nissan	NISSAN	LEAF
2021	GM	Cadillac	ESCALADE 4WD
2021	Porsche	Porsche	Macan GTS
2021	Tesla	Tesla Motors	Model X Long Range Plus
2021	GM	GMC	YUKON XL 4WD
2021	Porsche	Porsche	Taycan 4S Perf Battery
2021	GM	Chevrolet	COLORADO ZR2 4WD
2021	BMW	BMW	750i xDrive
2021	BMW	BMW	X3 M
2021	BMW	Mini	COOPER S CONVERTIBLE
2021	GM	GMC	CANYON 2WD
2021	FCA US LLC	Jeep	Cherokee FWD
2021	FOMOCO	Ford	MUSTANG CONVERTIBLE
2021	BMW	BMW	X3 xDrive30e
2021	Mercedes-Benz	Mercedes-Benz	GLS 580 4MATIC
2021	BMW	Mini	COOPER S HARDTOP 2 DOOR
2021	Volkswagen Group of	Audi	Q5 Sportback
2021	Toyota	TOYOTA	COROLLA HATCHBACK MANUAL
2021	Toyota	TOYOTA	AVALON TRD
2021	Kia	KIA MOTORS CORPORATION	Stinger RWD
2021	Jaguar Land Rover L	Land Rover	Defender 110 MHEV

MMBXT04.0U2A
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MKMXV02.5DP5
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MMBXV03.0HY4
MTYXV03.5M5C
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MGMXT02.0500
MFJXJ02.4CZA
MBMXV03.0G2X
MVVXJ02.0U70
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MKMXV01.6L13
MBMXV01.5B36
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MVGAV02.0VAB
MBMXJ02.0B4X
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MMBXT04.0HY1
MBMXV02.0B46
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MTYXV03.5M5B
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MJLXT03.0HTR

Ex. 4 CBI

2021	GM	Chevrolet	SUBURBAN 4WD
2021	Volkswagen Group of	Audi	S4
2021	Volkswagen Group of	Audi	A6 quattro
2021	Mercedes-Benz	Mercedes-Benz	GLS 450 4MATIC
2021	Volkswagen Group of	Audi	A5 Sportback quattro
2021	Kia	KIA MOTORS CORPORATION	Sportage FWD
2021	Kia	KIA MOTORS CORPORATION	Niro Electric
2021	Mercedes-Benz	Mercedes-Benz	CLA 250 4MATIC
2021	Toyota	TOYOTA	CAMRY TRD
2021	BMW	Mini	COOPER HARDTOP 2 DOOR
2021	Kia	KIA MOTORS CORPORATION	Stinger AWD
2021	Volvo	Volvo Cars of North America, LLC	S90 AWD
2021	MAZDA	MAZDA	CX-3 4WD
2021	BMW	BMW	M550i xDrive
2021	GM	Chevrolet	SUBURBAN 2WD
2021	BMW	BMW	X2 xDrive28i
2021	Volvo	Volvo Cars of North America, LLC	XC90 FWD
2021	FCA US LLC	Jeep	Wrangler 2dr 4X4
2021	Volkswagen Group of	Audi	A6 Allroad
2021	FCA US LLC	Dodge	Challenger AWD
2021	Jaguar Land Rover L	Land Rover	Range Rover LWB
2021	FOMOCO	Lincoln	CORSAIR AWD PHEV
2021	Kia	KIA MOTORS CORPORATION	Stinger RWD
2021	GM	GMC	SIERRA 4WD
2021	BMW	Mini	COOPER S COUNTRYMAN ALL4
2021	Nissan	INFINITI	Q60
2021	Mercedes-Benz	Mercedes-Benz	AMG A 35 4MATIC
2021	Volkswagen Group of	Audi	A5 quattro
2021	Volkswagen Group of	Volkswagen	Atlas Cross Sport 4Motion
2021	Jaguar Land Rover L	Land Rover	Defender 90 MHEV
2021	BMW	BMW	M235i xDrive Gran Coupe
2021	Kia	KIA MOTORS CORPORATION	Niro FE
2021	Tesla	Tesla Motors	Model S Long Range Plus
2021	BMW	BMW	X4 M40i
2021	FCA US LLC	Dodge	Durango SRT AWD
2021	Hyundai	HYUNDAI MOTOR COMPANY	Sonata Hybrid Blue
2021	Maserati	MASERATI	LEVANTE S
2021	MAZDA	MAZDA	CX-3 4WD
2021	Toyota	LEXUS	RX 450h L AWD
2021	Hyundai	HYUNDAI MOTOR COMPANY	Elantra Hybrid Blue
2021	SC Auto Sports, LLC	Kandi America	Kandi K23, (254Ah)
2021	Volvo	Volvo Cars of North America, LLC	XC40 AWD BEV
2021	Volkswagen Group of	Audi	A4 allroad quattro
2021	GM	GMC	CANYON 4WD
2021	Maserati	MASERATI	GHIBLI S Q4
2021	Toyota	TOYOTA	SEQUOIA 2WD
2021	Toyota	TOYOTA	AVALON HYBRID XLE

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MVGAJ03.0N7F
MVGAV03.0N7N
MMBXT03.0HY2
MVGAV02.0A7E
MKMXT02.0HG5
MKMXV00.0L31
MMBXV02.0U3C
MTYXV03.5M5B
MBMXV01.5B36
MKMXV03.3EK6
MVVXJ02.0S30
MTKXV02.0FFA
MBMXJ04.4N63
MGMXT06.2375
MBMXJ02.0B4X
MVVXJ02.0U70
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MCRXV03.65P3
MJLXT05.0FSN
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MKMXV02.0EG6
MGMXT04.3186
MBMXJ02.0B4X
MNSXV03.0NHA
MMBXV02.0U3A
MVGAJ02.0A7G
MVGAT03.6VAS
MJLXT03.0HTR
MBMXV02.0M48
MKMXV01.6L13
MTSLV00.0L2S
MBMXJ03.0B5X
MCRXT06.45P1
MHYXV02.0E13
MMAXJ03.0DFI
MTKXV02.5CDA
MTYXT03.5P3S
MHYXV01.6C13
MSCAV0.00MDP
MVVXV00.0Z0A
MVGAJ02.0A7G
MGMXT02.8358
MMAXJ03.0DFI
MTYXT05.7M5W
MTYXV02.5P33

Ex. 4 CBI

2021 Mitsubishi Motors Co	Mitsubishi Motors Corporation	Outlander PHEV
2021 Nissan	INFINITI	Q60 AWD
2021 Hyundai	GENESIS	G70 AWD
2021 GM	Cadillac	XT6 FWD
2021 BMW	Mini	COOPER CONVERTIBLE
2021 BMW	BMW	Z4 M40i
2021 Toyota	TOYOTA	COROLLA APEX
2021 MAZDA	MAZDA	MAZDA3 4-Door 2WD
2021 Hyundai	HYUNDAI MOTOR COMPANY	Veloster N
2021 Porsche	Porsche	Taycan 4S Perf Battery Plus
2021 Hyundai	GENESIS	G80 RWD
2021 Jaguar Land Rover L	Jaguar	I-PACE EV400
2021 GM	Cadillac	CT5
2021 FCA US LLC	Dodge	Challenger
2021 Volkswagen Group of	Bentley	Bentayga
2021 FCA US LLC	FIAT	500X AWD
2021 Jaguar Land Rover L	Jaguar	F-PACE P400 MHEV
2021 Mercedes-Benz	Mercedes-Benz	E 450 (convertible)
2021 GM	Chevrolet	CAMARO
2021 Porsche	Porsche	Cayenne S
2021 BMW	BMW	X2 sDrive28i
2021 Mercedes-Benz	Mercedes-Benz	E 450 4MATIC All-Terrain (wagon)
2021 FCA US LLC	Dodge	Challenger SRT Widebody
2021 FOMOCO	Ford	Transit Connect Van FWD
2021 GM	Cadillac	CT5 AWD
2021 Jaguar Land Rover L	Jaguar	I-PACE EV320
2021 FCA US LLC	ALFA ROMEO	Stelvio
2021 Volkswagen Group of	Audi	RS 5 Sportback
2021 Volkswagen Group of	Audi	e-tron Sportback
2021 Toyota	TOYOTA	CAMRY
2021 Porsche	Porsche	Cayenne GTS
2021 GM	Chevrolet	BLAZER FWD
2021 Hyundai	HYUNDAI MOTOR COMPANY	Veloster
2021 MAZDA	MAZDA	CX-3 2WD
2021 FCA US LLC	ALFA ROMEO	Giulia
2021 Volkswagen Group of	Audi	S6
2021 Porsche	Porsche	911 Carrera
2021 BMW	BMW	M850i xDrive Gran Coupe
2021 BMW	BMW	530e
2021 Mercedes-Benz	Mercedes-Benz	Metris (Cargo Van, LWB)
2021 GM	Cadillac	CT5 V
2021 BMW	BMW	Z4 sDrive30i
2021 Kia	KIA MOTORS CORPORATION	Soul
2021 Mercedes-Benz	Mercedes-Benz	AMG CLA 35 4MATIC
2021 Hyundai	HYUNDAI MOTOR COMPANY	Veloster
2021 Volkswagen Group of	Lamborghini	Urus
2021 Volkswagen Group of	Audi	A8L

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MHYXV03.3GK6
MGMXT02.0500
MBMXV01.5B36
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MTYXV02.0P3A
MTKXV02.0CDB
MHYXV02.0BG6
MPRXV00.0EVT
MHYXV03.5HT5
MJLXT00.0TZA
MGMXV03.0043
MCRXV05.75P4
MVGAT04.0PAA
MCRXT01.35P0
MJLXJ03.0FSC
MMBXV03.0HY4
MGMXV06.2089
MPRXT03.0CV6
MBMXJ02.0B4X
MMBXV03.0HY4
MCRXV06.25P0
MFMXT02.52NG
MGMXV03.0043
MJLXT00.0TZA
MCRXJ02.05P2
MVGAV02.9N7B
MVGAT00.0AZE
MTYXV03.5M5B
MPRXT04.0CV8
MGMXT02.0500
MHYXV01.6BC5
MTKXV02.0FFA
MCRXJ02.05P2
MVGAV02.9N7S
MPRXV03.0C92
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MMBXT02.0U3B
MGMXV03.0043
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MMBXV02.0U3A
MHYXV02.0BE5
MVGAT04.0PAA
MVGAV03.0N7R

Ex. 4 CBI

2021	FOMOCO	Ford	MUSTANG MACH-E CALIFORNIA ROUTE1
2021	Mercedes-Benz	Mercedes-Benz	E 450 (coupe)
2021	Volkswagen Group of	Audi	SQ8
2021	BMW	Mini	COOPER SE HARDTOP 2 DOOR
2021	Hyundai	HYUNDAI MOTOR COMPANY	Ioniq Electric
2021	Porsche	Porsche	911 Turbo S
2021	Toyota	TOYOTA	MIRAI LIMITED
2021	FCA US LLC	Jeep	Cherokee 4x4 Active Drive II
2021	Volkswagen Group of	Audi	A7 quattro
2021	Hyundai	HYUNDAI MOTOR COMPANY	Ioniq Plug-in Hybrid
2021	FCA US LLC	Dodge	Challenger SRT
2021	GM	Cadillac	CT5 V AWD
2021	MAZDA	MAZDA	CX-3 2WD
2021	BMW	BMW	M3 Competition
2021	GM	Chevrolet	SUBURBAN 2WD
2021	Mercedes-Benz	Mercedes-Benz	AMG GLC 43 4MATIC
2021	BMW	BMW	X5 M
2021	GM	Chevrolet	SILVERADO 2WD CAB CHASSIS
2021	Mercedes-Benz	Mercedes-Benz	AMG GLE 63 S 4MATIC+ (coupe)
2021	Toyota	LEXUS	RC 350
2021	BMW	Mini	COOPER S COUNTRYMAN
2021	FCA US LLC	Jeep	Renegade 4x2
2021	FOMOCO	Ford	TRANSIT CONNECT WAGON LWB FFV
2021	Volkswagen Group of	Audi	A8L
2021	GM	GMC	YUKON 2WD
2021	Porsche	Porsche	Cayenne Coupé
2021	Mercedes-Benz	Mercedes-Benz	AMG GLE 63 S 4MATIC+
2021	Volvo	Volvo Cars of North America, LLC	V60 FWD
2021	Hyundai	GENESIS	GV80 RWD
2021	BMW	Mini	COOPER COUNTRYMAN
2021	Mercedes-Benz	Mercedes-Benz	CLS 450
2021	BMW	BMW	840i xDrive Gran Coupe
2021	Mercedes-Benz	Mercedes-Benz	AMG GLA 35 4MATIC
2021	FOMOCO	Ford	MUSTANG HO COUPE
2021	BMW	BMW	M4 Competition Coupe
2021	Mercedes-Benz	Mercedes-Benz	AMG C 43 4MATIC
2021	BMW	BMW	530e xDrive
2021	Volvo	Volvo Cars of North America, LLC	V90 CC AWD
2021	Hyundai	GENESIS	G80 AWD
2021	Maserati	MASERATI	GHIBLI
2021	BMW	BMW	X4 M
2021	BMW	BMW	840i Gran Coupe
2021	FOMOCO	Lincoln	NAVIGATOR 2WD
2021	Kia	KIA MOTORS CORPORATION	Niro Plug-in Hybrid
2021	Volkswagen Group of	Audi	RS 7
2021	Volkswagen Group of	Audi	A8L
2021	Ferrari	Ferrari North America, Inc.	F8 Spider

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MBMXV00.0F5B
MHYXV00.0P31
MPRXV04.0S82
MTYXV00.0DA7
MCRXT03.25P0
MVGAJ02.0A3P
MHYXV01.6P2T
MCRXV06.25P0
MGMXV03.0043
MTKXV02.5CDA
MBMXV03.0SM3
MGMXT03.0353
MMBXJ03.0U2A
MBMXJ04.4SM5
MGMXT04.3186
MMBXT04.0HY2
MTYXV03.5M5A
MBMXJ02.0B4X
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MFMXT02.02MI
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MGMXT03.0353
MPRXT03.0CV6
MMBXT04.0HY2
MVVXJ02.0U70
MHYXT02.5TP5
MBMXV01.5B36
MMBXV03.0HY4
MBMXJ03.0B07
MMBXV02.0U3A
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MBMXV03.0SM3
MMBXJ03.0U2A
MBMXJ02.0H30
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MVGAV03.0NAP
MFEXV03.9TUR

Ex. 4 CBI

2021	BMW	Mini	COOPER S CLUBMAN
2021	FCA US LLC	ALFA ROMEO	Giulia AWD
2021	Mercedes-Benz	Mercedes-Benz	GLS 600 4MATIC Maybach
2021	Toyota	LEXUS	LC 500
2021	FCA US LLC	Jeep	Cherokee 4x4 Active Drive II
2021	Jaguar Land Rover L	Land Rover	Range Rover
2021	Mercedes-Benz	Mercedes-Benz	C 300 (convertible)
2021	FCA US LLC	Chrysler	300 AWD
2021	Toyota	TOYOTA	LAND CRUISER WAGON 4WD
2021	Mercedes-Benz	Mercedes-Benz	AMG GLS 63 4MATIC+
2021	Volkswagen Group of	Audi	S5
2021	Kia	KIA MOTORS CORPORATION	Stinger AWD
2021	Mercedes-Benz	Mercedes-Benz	C 300 (Coupe)
2021	BMW	TOYOTA	Supra 2.0
2021	Mercedes-Benz	Mercedes-Benz	AMG GT 43 4MATIC+
2021	FCA US LLC	Chrysler	300
2021	BMW	BMW	M5 Competition
2021	Porsche	Porsche	911 Carrera S
2021	FCA US LLC	Dodge	Durango SRT AWD
2021	Mercedes-Benz	Mercedes-Benz	E 450 4MATIC (coupe)
2021	Volvo	Volvo Cars of North America, LLC	S60 AWD
2021	Mercedes-Benz	Mercedes-Benz	E 450 4MATIC (convertible)
2021	BMW	BMW	I3
2021	Volkswagen Group of	Volkswagen	ID.4 1st
2021	GM	Cadillac	ESCALADE 2WD
2021	Porsche	Porsche	Macan Turbo
2021	GM	Chevrolet	SILVERADO 4WD
2021	Volkswagen Group of	Bentley	Continental GT Convertible
2021	GM	Chevrolet	SILVERADO 2WD
2021	Hyundai	HYUNDAI MOTOR COMPANY	NEXO
2021	aston martin	Aston Martin Lagonda Ltd	DBX V8
2021	Jaguar Land Rover L	Jaguar	F-TYPE Convertible
2021	Nissan	INFINITI	Q50 AWD RED SPORT
2021	Porsche	Porsche	718 Cayman GT4
2021	Volkswagen Group of	Audi	RS 6 Avant
2021	GM	GMC	CANYON 4WD
2021	GM	Cadillac	CT4 AWD
2021	BMW	BMW	740i xDrive
2021	BMW	BMW	X6 M
2021	Kia	KIA MOTORS CORPORATION	Niro Touring
2021	BMW	BMW	X6 M50i
2021	BMW	Mini	COOPER COUNTRYMAN ALL4
2021	Porsche	Porsche	911 Carrera Cabriolet
2021	GM	Chevrolet	COLORADO 2WD
2021	Volkswagen Group of	Audi	A6 quattro
2021	GM	Cadillac	CT4
2021	Porsche	Porsche	Cayenne GTS Coupe

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MTYXV05.0M5A
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MJLXT03.0GTR
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MCRXV03.65P3
MTYXT05.7K6Y
MMBXT04.0HY3
MVGAJ03.0N7F
MKMXV02.0EG6
MMBXJ02.0U3A
MBMXJ02.0B4X
MMBXV03.0HY2
MCRXV05.75P3
MBMXJ04.4SM5
MPRXV03.0C92
MCRXT06.25P1
MMBXV03.0HY4
MVVXJ02.0P3A
MMBXV03.0HY4
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MVGAT00.0VZR
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MPRXT03.0CV6
MGMXT05.3385
MVGAV04.0PAA
MGMXT05.3385
MHYXV00.0R41
MASXJ04.0AEX
MJLXJ02.0RTX
MNSXV03.0NHA
MPRXV04.0S82
MVGAJ04.0NAT
MGMXT02.5200
MGMXV02.7105
MBMXJ03.0B07
MBMXJ04.4SM5
MKMXV01.6L13
MBMXJ04.4N63
MBMXV01.5B36
MPRXV03.0C92
MGMXT02.8358
MVGAV02.0A7M
MGMXV02.7105
MPRXT04.0CV8

Ex. 4 CBI

2021	Mercedes-Benz	Mercedes-Benz	AMG GLC 43 4MATIC (coupe)
2021	Volkswagen Group of	Audi	S5 Cabriolet
2021	Mercedes-Benz	Mercedes-Benz	CLS 450 4MATIC
2021	GM	Cadillac	XT5 HEARSE FWD
2021	Volkswagen Group of	Audi	RS 5
2021	GM	Cadillac	XT6 AWD
2021	Porsche	Porsche	718 Boxster
2021	Nissan	INFINITI	Q50 RED SPORT
2021	Mercedes-Benz	Mercedes-Benz	AMG E 63 S 4MATIC+
2021	Jaguar Land Rover L	Land Rover	Range Rover Sport SVR
2021	Jaguar Land Rover L	Jaguar	F-TYPE Coupe
2021	GM	GMC	YUKON XL 2WD
2021	Porsche	Porsche	911 Turbo S Cabriolet
2021	Porsche	Porsche	718 Cayman
2021	Jaguar Land Rover L	Land Rover	Defender 90
2021	GM	Cadillac	CT4 V
2021	BMW	BMW	M850i xDrive Convertible
2021	Maserati	MASERATI	QUATTROPORTE S Q4
2021	Ferrari	Ferrari North America, Inc.	Roma
2021	Rolls-Royce	Rolls-Royce Motor Cars Limited	Cullinan
2021	Mercedes-Benz	Mercedes-Benz	C 300 4MATIC (convertible)
2021	Toyota	LEXUS	RC 300 AWD
2021	Volkswagen Group of	Audi	RS Q8
2021	GM	Chevrolet	SPARK ACTIV
2021	Porsche	Porsche	Cayenne S Coupé
2021	BMW	BMW	230i Coupe
2021	Porsche	Porsche	911 Targa 4S
2021	BMW	Mini	MINI COOPER SE COUNTRYMAN ALL4
2021	Mercedes-Benz	Mercedes-Benz	C 300 4MATIC (Coupe)
2021	Porsche	Porsche	911 Carrera 4S
2021	BMW	BMW	X6 sDrive40i
2021	Mercedes-Benz	Mercedes-Benz	AMG GLB 35 4MATIC
2021	Mercedes-Benz	Mercedes-Benz	GLE 580 4MATIC
2021	Ferrari	Ferrari North America, Inc.	F8 Tributo
2021	BMW	BMW	X3 M Competition
2021	Volkswagen Group of	Bentley	Continental GT
2021	GM	GMC	SIERRA 4WD
2021	Mercedes-Benz	Mercedes-Benz	AMG C 43 4MATIC (coupe)
2021	Volkswagen Group of	Audi	S7
2021	Porsche	Porsche	911 Carrera S Cabriolet
2021	Jaguar Land Rover L	Land Rover	Discovery
2021	FCA US LLC	Jeep	Grand Cherokee SRT 4x4
2021	Porsche	Porsche	Taycan Turbo S
2021	GM	Cadillac	CT4 V AWD
2021	Hyundai	GENESIS	G90 RWD
2021	Jaguar Land Rover L	Jaguar	XE P250 AWD
2021	Mercedes-Benz	Mercedes-Benz	AMG GLA 45 4MATIC

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MMBXV03.0HY4
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MVGAV02.9N7B
MGMXT02.0500
MPRXV02.5B82
MNSXV03.0NHA
MMBXV04.0U2A
MJLXT05.0FSN
MJLXJ02.0RTX
MGMXT03.0353
MPRXV04.0S82
MPRXV02.5B82
MJLXT02.0RTW
MGMXV02.7105
MBMXJ04.4N63
MMAXJ03.0DFI
MFEXV03.9T50
MRRGV06.7N74
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MMBXJ03.0U2A
MVGAV02.9N7S
MPRXV03.0C92
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MCRXT06.45P1
MPRXV00.0EVT
MGMXV02.7105
MHYXV03.3JK6
MJLXJ02.0RTX
MMBXV02.0U3B

Ex. 4 CBI

2021	Volkswagen Group of	Audi	SQ5 Sportback
2021	BMW	BMW	M240i Coupe
2021	Nissan	INFINITI	Q60 RED SPORT
2021	Jaguar Land Rover L	Land Rover	Defender 110
2021	Porsche	Porsche	718 Cayman GTS 4.0
2021	BMW	BMW	M240i xDrive Convertible
2021	Volkswagen Group of	Audi	S8
2021	BMW	Mini	COOPER S CLUBMAN ALL4
2021	Hyundai	GENESIS	G90 RWD
2021	Mercedes-Benz	Mercedes-Benz	AMG GT 53 4MATIC+
2021	Porsche	Porsche	718 Spyder
2021	Toyota	LEXUS	RC 300
2021	FOMOCO	Ford	TRANSIT T150 WAGON 4WD FFV
2021	Jaguar Land Rover L	Land Rover	Range Rover Sport PHEV
2021	BMW	BMW	M240i xDrive Coupe
2021	GM	Chevrolet	SILVERADO 4WD CAB CHASSIS
2021	Porsche	Porsche	Cayenne Turbo
2021	Mercedes-Benz	Mercedes-Benz	AMG GT 63 4MATIC+
2021	BMW	BMW	M4 Coupe
2021	BMW	Mini	John Cooper Works GP
2021	Volkswagen Group of	Lamborghini	Huracan Spyder 2WD
2021	Porsche	Porsche	911 Carrera 4S Cabriolet
2021	BMW	BMW	I3 with Range Extender
2021	Nissan	INFINITI	Q60 AWD RED SPORT
2021	GM	GMC	SIERRA 2WD
2021	Porsche	Porsche	718 Boxster GTS 4.0
2021	BMW	BMW	M3
2021	FOMOCO	Ford	EXPLORER FFV AWD
2021	Jaguar Land Rover L	Land Rover	Range Rover Sport
2021	Maserati	MASERATI	GHIBLI S
2021	Mercedes-Benz	Mercedes-Benz	AMG E53 4MATIC+ (Coupe)
2021	BMW	BMW	M850i xDrive Coupe
2021	FOMOCO	Lincoln	NAVIGATOR L 2WD
2021	BMW	BMW	M5
2021	Volkswagen Group of	Bentley	Flying Spur
2021	Volkswagen Group of	Bentley	Flying Spur
2021	Mercedes-Benz	Mercedes-Benz	AMG C 43 4MATIC (convertible)
2021	BMW	BMW	M2 Competition Coupe
2021	Mercedes-Benz	Mercedes-Benz	AMG GT 63 S 4MATIC+
2021	Porsche	Porsche	Cayenne Turbo Coupé
2021	Jaguar Land Rover L	Land Rover	Range Rover PHEV
2021	BMW	BMW	X2 M35i
2021	FOMOCO	Ford	TRANSIT CONNECT VAN FFV
2021	FCA US LLC	Jeep	Grand Cherokee Trackhawk 4x4
2021	Ferrari	Ferrari North America, Inc.	SF90 Stradale Coupe
2021	Jaguar Land Rover L	Jaguar	XE P300 AWD
2021	Mercedes-Benz	Mercedes-Benz	AMG E53 4MATIC+

MVGAJ03.0N7F
MBMXJ03.0B07
MNSXV03.0NHA
MJLXT02.0RTW
MPRXV04.0S82
MBMXJ03.0B07
MVGAJ04.0NAT
MBMXJ02.0B4X
MHYXV05.0JM5
MMBXV03.0HY2
MPRXV04.0S82
MTYXV02.0M5A
MFMXT03.55HM
MJLXT02.0PTW
MBMXJ03.0B07
MGMXT04.3186
MPRXT04.0CV8
MMBXJ04.0U2A
MBMXV03.0SM3
MBMXV02.0M48
MVGAV05.2NDE
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MPRXV04.0S82
MBMXV03.0SM3
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MJLXT03.0GTR
MMAXJ03.0DFI
MMBXV03.0HY2
MBMXJ04.4N63
MFMXT03.54HF
MBMXJ04.4SM5
MVGAV04.0PAA
MVGAV06.0EAR
MMBXJ03.0U2A
MBMXV03.0S55
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MPRXT04.0CV8
MJLXT02.0PTW
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MCRXT06.25P1
MFEXV03.9HYB
MJLXJ02.0RTX
MMBXV03.0HY2

Ex. 4 CBI

2021 Mercedes-Benz	Mercedes-Benz	AMG E53 4MATIC+ (Convertible)
2021 BMW	BMW	745e xDrive
2021 Volkswagen Group of	Lamborghini	Huracan 2WD
2021 Tesla	Tesla Motors	Model S Performance (21" Wheels)
2021 Mercedes-Benz	Mercedes-Benz	AMG CLA 45 4MATIC
2021 Maserati	MASERATI	GHIBLI TROFEO
2021 Hyundai	GENESIS	G90 AWD
2021 GM	GMC	CANYON 2WD
2021 Mercedes-Benz	Mercedes-Benz	AMG GLC 63 4MATIC+
2021 BMW	BMW	840i Convertible
2021 Nissan	NISSAN	GT-R
2021 Lotus	Lotus Cars Ltd	Evora GT
2021 aston martin	Aston Martin Lagonda Ltd	Vantage V8
2021 Maserati	MASERATI	QUATTROPORTE S
2021 Volkswagen Group of	Bentley	Continental GT Convertible
2021 GM	Cadillac	XT5 HEARSE AWD
2021 BMW	BMW	ALPINA XB7
2021 BMW	BMW	X5 M Competition
2021 Ferrari	Ferrari North America, Inc.	812 GTS
2021 BMW	Mini	JOHN COOPER WORKS HARDTOP
2021 BMW	BMW	840i xDrive Convertible
2021 BMW	BMW	230i Convertible
2021 BMW	BMW	M8 Competition Gran Coupe
2021 Hyundai	GENESIS	G90 AWD
2021 Tesla	Tesla Motors	Model X Performance (22" Wheels)
2021 Maserati	MASERATI	LEVANTE GTS
2021 FCA US LLC	ALFA ROMEO	Stelvio AWD
2021 Volkswagen Group of	Audi	R8
2021 BMW	BMW	Alpina B7
2021 Hyundai	HYUNDAI MOTOR COMPANY	NEXO Blue
2021 Mercedes-Benz	Mercedes-Benz	AMG C 63 S (coupe)
2021 BMW	BMW	X4 M Competition
2021 BMW	BMW	M760i xDrive
2021 Mercedes-Benz	Mercedes-Benz	S 560 4MATIC (coupe)
2021 BMW	BMW	I3s
2021 Honda	Honda	Clarity
2021 BMW	BMW	230i xDrive Coupe
2021 Mercedes-Benz	Mercedes-Benz	AMG GLC 63 S 4MATIC+ (coupe)
2021 Karma Automotive, L	Karma Automotive LLC	GS-6 (21-inch wheels)
2021 Karma Automotive, L	Karma Automotive LLC	Revero GT (21-inch wheels)
2021 Mercedes-Benz	Mercedes-Benz	Metris (Passenger Van)
2021 BMW	BMW	840i xDrive Coupe
2021 Volkswagen Group of	Bentley	Continental GT
2021 BMW	BMW	840i Coupe
2021 Karma Automotive, L	Karma Automotive LLC	GS-6 (22-inch wheels)
2021 Karma Automotive, L	Karma Automotive LLC	Revero GT (22-inch wheels)
2021 Jaguar Land Rover L	Land Rover	Range Rover Velar

MMBXV03.0HY2
MBMXV03.0H58
MVGAV05.2NDE
MTSLV00.0L2S
MMBXV02.0U3B
MMAXJ03.8DFI
MHYXV05.0JM5
MGMXT02.8358
MMBXJ04.0U2A
MBMXJ03.0B07
MNSXV03.8NBA
MLTXV03.5JHB
MASXV04.0AES
MMAXJ03.0DFI
MVGAV06.0EAR
MGMXT02.0550
MBMXJ04.4N63
MBMXJ04.4SM5
MFEXV06.5GDI
MBMXV02.0B46
MBMXJ03.0B07
MBMXJ02.0B4X
MBMXJ04.4SM5
MHYXV03.3JK6
MTSLV00.0L2X
MMAXJ03.8DFI
MCRXJ02.95P0
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MBMXJ04.4N63
MHYXV00.0R41
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MBMXV00.0I3B
MHNXV00.0AAH
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MKALV01.5K12
MKALV01.5K12
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MVGAV06.0EAR
MBMXJ03.0B07
MKALV01.5K12
MKALV01.5K12
MJLXJ05.0FSM

Ex. 4 CBI

2021 Jaguar Land Rover L	Jaguar	XE P250
2021 Jaguar Land Rover L	Jaguar	XF P250
2021 Volkswagen Group of	Audi	TT Coupe quattro
2021 Mercedes-Benz	Mercedes-Benz	AMG CLS53 4MATIC+
2021 Porsche	Porsche	718 Boxster S
2021 Jaguar Land Rover L	Jaguar	XF P250 AWD
2021 Mercedes-Benz	Mercedes-Benz	AMG E 63 S 4MATIC+ (SW)
2021 Volvo	Volvo Cars of North America, LLC	V90 AWD
2021 BMW	BMW	230i xDrive Convertible
2021 Toyota	LEXUS	RC F
2021 BMW	BMW	M8 Gran Coupe
2021 BMW	BMW	X6 M Competition
2021 Porsche	Porsche	718 Cayman S
2021 Volvo	Volvo Cars of North America, LLC	V90 FWD
2021 GM	GMC	SIERRA 4WD CAB CHASSIS
2021 Mercedes-Benz	Mercedes-Benz	S 560 (convertible)
2021 Toyota	LEXUS	RC 350 AWD
2021 Volkswagen Group of	Bentley	Bentayga
2021 Mercedes-Benz	Mercedes-Benz	AMG C 63 S
2021 Jaguar Land Rover L	Land Rover	Range Rover SVA
2021 BMW	BMW	M240i Convertible
2021 Mercedes-Benz	Mercedes-Benz	AMG C 63
2021 Volkswagen Group of	Audi	R8 Spyder
2021 Mercedes-Benz	Mercedes-Benz	AMG GT (roadster)
2021 Tesla	Tesla Motors	Model S Performance (19" Wheels)
2021 FCA US LLC	RAM	1500 HFE 4X2
2021 Volkswagen Group of	Audi	TT Roadster quattro
2021 Toyota	LEXUS	LS 500h
2021 Ferrari	Ferrari North America, Inc.	Portofino
2021 Ferrari	Ferrari North America, Inc.	Portofino M
2021 BMW	Mini	JOHN COOPER WORKS CONVERTIBLE
2021 MAZDA	MAZDA	MAZDA2
2021 Volvo	Volvo Cars of North America, LLC	S90 AWD
2021 Rolls-Royce	Rolls-Royce Motor Cars Limited	Dawn
2021 Volkswagen Group of	Audi	TT RS
2021 FOMOCO	Ford	MUSTANG HO CONVERTIBLE
2021 FOMOCO	Ford	Transit Connect Wagon LWB FWD
2021 BMW	Mini	JCW COUNTRYMAN ALL4
2021 Volkswagen Group of	Bentley	Bentayga
2021 aston martin	Aston Martin Lagonda Ltd	DB11 V8
2021 Jaguar Land Rover L	Jaguar	F-TYPE S AWD Convertible
2021 Mercedes-Benz	Mercedes-Benz	AMG GLC 63 4MATIC+ (coupe)
2021 Mercedes-Benz	Mercedes-Benz	AMG C 63 (coupe)
2021 Maserati	MASERATI	QUATTROPORTE TROFEO
2021 Porsche	Porsche	718 Cayman T
2021 Volvo	Volvo Cars of North America, LLC	V60 AWD
2021 FOMOCO	Ford	FORD GT

MJLXJ02.0RTX
MJLXJ02.0RTX
MVGAJ02.0A3T
MMBXV03.0HY2
MPRXV02.5B82
MJLXJ02.0RTX
MMBXV04.0U2A
MVVXJ02.0S30
MBMXJ02.0B4X
MTYXV05.0M5A
MBMXJ04.4SM5
MBMXJ04.4SM5
MPRXV02.5B82
MVVXJ02.0U70
MGMXT04.3186
MMBXJ04.0U2A
MTYXV03.5M5A
MVGAT03.0NAQ
MMBXV04.0U2A
MJLXT05.0FSN
MBMXJ03.0B07
MMBXV04.0U2A
MVGAV05.2NBE
MMBXV04.0U2A
MTSLV00.0L2S
MCRXT03.65P7
MVGAJ02.0A3T
MTYXV03.5P35
MFEXV03.9TUR
MFEXV03.9T50
MBMXV02.0B46
MTKXV01.5FNM
MVVXJ02.0P3A
MRRGV06.6N74
MVGAV02.5NAG
MFMXV02.3VJY
MFMXT02.52NG
MBMXV02.0M48
MVGAT06.0EAR
MASXV04.0AES
MJLXV03.0FSP
MMBXJ04.0U2A
MMBXV04.0U2A
MMAXJ03.8DFI
MPRXV02.5B82
MVVXJ02.0P3A
MFMXV03.5VGT

Ex. 4 CBI

2021	Volkswagen Group of	Lamborghini	Aventador Roadster
2021	Rolls-Royce	Rolls-Royce Motor Cars Limited	Phantom
2021	Jaguar Land Rover L	Jaguar	F-TYPE S AWD Coupe
2021	Porsche	Porsche	911 Turbo
2021	Porsche	Porsche	Taycan Turbo
2021	Volkswagen Group of	Lamborghini	Huracan
2021	aston martin	Aston Martin Lagonda Ltd	DBS
2021	BMW	Mini	JOHN COOPER WORKS CLUBMAN ALL4
2021	Rolls-Royce	Rolls-Royce Motor Cars Limited	Wraith
2021	Mercedes-Benz	Mercedes-Benz	AMG GT (coupe)
2021	Maserati	MASERATI	LEVANTE TROFEO
2021	Jaguar Land Rover L	Jaguar	XF P300 AWD
2021	FCA US LLC	ALFA ROMEO	Giulia
2021	Honda	Acura	NSX
2021	Porsche	Porsche	718 Boxster T
2021	Tesla	Tesla Motors	Model X Performance (20" Wheels)
2021	Mercedes-Benz	Mercedes-Benz	AMG S 63 4MATIC+ (coupe)
2021	FOMOCO	Ford	RANGER 2WD INCOMPLETE
2021	Jaguar Land Rover L	Jaguar	F-TYPE R AWD Convertible
2021	Mercedes-Benz	Mercedes-Benz	AMG C 63 (convertible)
2021	Rolls-Royce	Rolls-Royce Motor Cars Limited	Cullinan Black Badge
2021	Mercedes-Benz	Mercedes-Benz	AMG GT C (roadster)
2021	Mercedes-Benz	Mercedes-Benz	AMG GT C (coupe)
2021	Rolls-Royce	Rolls-Royce Motor Cars Limited	Ghost
2021	Mercedes-Benz	Mercedes-Benz	AMG C 63 S (convertible)
2021	Porsche	Porsche	911 Carrera 4
2021	Ferrari	Ferrari North America, Inc.	812 Superfast
2021	Jaguar Land Rover L	Jaguar	F-TYPE R AWD Coupe
2021	Volkswagen Group of	Audi	R8 2WD
2021	Porsche	Porsche	911 Turbo Cabriolet
2021	Volkswagen Group of	Lamborghini	Aventador Coupe
2021	Mercedes-Benz	Mercedes-Benz	AMG S 63 4MATIC+ (convertible)
2021	BMW	BMW	M8 Competition Convertible
2021	aston martin	Aston Martin Lagonda Ltd	Vantage Manual
2021	Jaguar Land Rover L	Jaguar	F-TYPE S Coupe
2021	Porsche	Porsche	911 Carrera 4 Cabriolet
2021	Porsche	Porsche	911 Targa 4
2021	FCA US LLC	RAM	1500 HFE 4X2
2021	Jaguar Land Rover L	Land Rover	Range Rover LWB SVA
2021	Rolls-Royce	Rolls-Royce Motor Cars Limited	Ghost EWB
2021	Rolls-Royce	Rolls-Royce Motor Cars Limited	Phantom EWB
2021	Toyota	LEXUS	LC 500h
2021	BMW	BMW	M8 Convertible
2021	aston martin	Aston Martin Lagonda Ltd	DB11 V12
2021	Volkswagen Group of	Audi	R8 Spyder 2WD
2021	Volvo	Polestar Automotive USA Inc	Polestar 1
2021	Rolls-Royce	Rolls-Royce Motor Cars Limited	Dawn Black Badge

MVGAV06.5LDR
MRRGV06.7N74
MJLXV03.0FSP
MPRXV04.0S82
MPRXV00.0EVT
MVGAV05.2NDE
MASXV05.2AM5
MBMXV02.0M48
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MMBXV04.0U2A
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MCRXJ02.95P0
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MPRXV02.5B82
MTSLV00.0L2X
MMBXJ04.0U2A
MFMXT02.33MC
MJLXJ05.0FSM
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MMBXV04.0U2A
MMBXV04.0U2A
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MMBXV04.0U2A
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MPRXV04.0S82
MVGAV06.5LDR
MMBXJ04.0U2A
MBMXJ04.4SM5
MASXV04.0AES
MJLXV03.0FSP
MPRXV03.0C92
MPRXV03.0C92
MCRXT03.05PW
MJLXT05.0FSN
MRRGV06.7N74
MRRGV06.7N74
MTYXV03.5P35
MBMXJ04.4SM5
MASXV05.2AM5
MVGAV05.2NBE
MVVXV02.0P3R
MRRGV06.6N74

Ex. 4 CBI

2021	Rolls-Royce	Rolls-Royce Motor Cars Limited	Wraith Black Badge
2021	Volkswagen Group of	Audi	TTS Coupe
2021	Volkswagen Group of	Bugatti	Chiron
2021	Mercedes-Benz	Mercedes-Benz	AMG GT R (coupe)
2021	Toyota	LEXUS	UX 250h
2021	Toyota	LEXUS	LS 500h AWD
2021	Volkswagen Group of	Lamborghini	Huracan Spyder
2021	Jaguar Land Rover L	Jaguar	F-TYPE S Convertible
2021	Nissan	NISSAN	370Z
2021	Volkswagen Group of	Bugatti	Chiron Pur Sport
2021	GM	Chevrolet	SILVERADO 4WD CAB CHASSIS
2021	GM	GMC	SIERRA 4WD CAB CHASSIS
2021	GM	Cadillac	XT5 LIMO AWD
2021	GM	Cadillac	XT5 LIMO FWD
2021	GM	Chevrolet	SILVERADO 2WD CAB CHASSIS
2021	GM	GMC	SIERRA 2WD CAB CHASSIS
2021	GM	GMC	SIERRA 2WD CAB CHASSIS
2021	Kia	KIA MOTORS CORPORATION	Soul Electric

MRRGV06.6N74
MVGAV02.0AAB
MVGAV08.0GLB
MMBXV04.0U2A
MTYXV02.0P3B
MTYXV03.5P35
MVGAV05.2NDE
MJLXV03.0FSP
MNSXV03.7NAA
MVGAV08.0GLB
MGMXT05.3386
MGMXT05.3386
MGMXT02.0550
MGMXT02.0550
MGMXT05.3386
MGMXT04.3186
MGMXT05.3386
MKMXV00.0B31

Ex. 4 CBI

Message

From: Michael Hartrick [Mhartrick@autosinnovate.org]
Sent: 11/12/2020 4:09:03 PM
To: Wehrly, Linc [wehrly.linc@epa.gov]
Subject: Fuel Economy Cut-Point - MY 2020 Analysis
Attachments: ATT00001.txt; Model Year 2020 Based Fuel Economy Cut-Points Report.docx; Model Year 2020 Based Fuel Economy Cut-Points Data.xlsb

Linc,

Please see the attached study of potential high fuel economy confirmatory test cut-points and the associated data set.

- We believe CD-2020-07 should continue the temporary guidance for MY 2022. Have you had a chance to consider this yet?
- When it is time to cancel the temporary CD-2020-07 guidance and release an update to CD-15-22, the attached analysis is hopefully informative.
- We believe that the cut-points associated with the 3rd percentile analysis would be appropriate for updated guidance. These cut-points would yield a confirmatory test rate of ~3% on the model year 2020 fleet. As we have seen in the past, it is likely that that rate will rise as vehicles are redesigned for higher fuel economy over the next several years unless and until we collectively develop a new way to determine when a vehicle should be confirmed for "high fuel economy".

Please let me know when you are ready to discuss updates further. I'll follow up on this in a couple of weeks. In the meantime, can you please get back to me on thoughts regarding CD-2020-07 extension to MY 2022 and an update to the shift survey guidance? Thanks.

Michael Hartrick
Senior Director, Environment & Energy
O: 248.327.1760 C: 248.212.3590
Alliance for Automotive Innovation
2000 Town Center - Suite 625, Southfield, MI 48075
autosinnovate.org - twitter - linkedin

Message

From: Wright, DavidA [Wright.DavidA@epa.gov]
Sent: 3/15/2021 2:50:57 PM
To: Wehrly, Linc [wehrly.linc@epa.gov]
Subject: BEV Issues
Attachments: Initial list of EV testing issues 03 10 2021a.pdf

David Wright
Light-Duty Vehicle Center – Compliance Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Message

From: French, Roberts [french.roberts@epa.gov]
Sent: 4/2/2019 9:25:10 PM
To: Wehrly, Linc [wehrly.linc@epa.gov]; Wright, DavidA [Wright.DavidA@epa.gov]; Anderson, Tom [Anderson.Tom@epa.gov]; Snyder, Jim [Snyder.Jim@epa.gov]
Subject: FW: more letters from Byron
Attachments: conditional-exemption-letter-my13-14 Lotus.pdf; conditional-exemption-letter-my13-14 McLaren.pdf; conditional-exemption-letter-my13-14 Aston.pdf

I also found considerable back-and-forth on many of the SVM issues, good faith effort language, etc., between Byron, myself, ASD, and OGC. If I see anything relevant to today's discussions I will forward it along.

Rob

Roberts W. French, Jr.
U.S. Environmental Protection Agency
National Vehicle and Fuel Emissions Laboratory
2000 Traverwood Drive
Ann Arbor, Michigan 48105
(734) 214-4380

From: Pugliese, Holly
Sent: Wednesday, March 9, 2016 2:35 PM
To: French, Roberts <french.roberts@epa.gov>
Cc: Zaremski, Sara <zaremski.sara@epa.gov>; Wehrly, Linc <wehrly.linc@epa.gov>
Subject: RE: more letters from Byron

Here you go. I will have them sent via regular mail.

Holly Pugliese
Office of Transportation and Air Quality
US EPA
pugliese.holly@epa.gov

From: French, Roberts
Sent: Wednesday, March 09, 2016 11:07 AM
To: Pugliese, Holly <pugliese.holly@epa.gov>
Cc: Zaremski, Sara <zaremski.sara@epa.gov>; Wehrly, Linc <wehrly.linc@epa.gov>
Subject: more letters from Byron

Holly,

I'm apparently not done figuring out new ways to annoy manufacturers. Here are three more letters to go out under Byron's signature. Like the other recent ones, they can be emailed by Linc.

Email addresses are:

Peter Montague, McLaren peter.montague@mclaren.com
Jon Yarrow, Aston Martin Jon.Yarrow@astonmartin.com
Ian Cawdron, Lotus ICawdron@lotuscars.com

Would you mind reading through these? The letters are similar, but to three different companies, and a second set of eyes to make sure that I didn't leave an "Aston Martin" in the McLaren letter, for example, would be helpful.

Byron has approved these letters already.

Thanks!

Rob

Roberts W. French, Jr.
U.S. Environmental Protection Agency
National Vehicle and Fuel Emissions Laboratory
2000 Traverwood Drive
Ann Arbor, Michigan 48105
(734) 214-4380

Message

From:	Parsons, Christy [Parsons.Christy@epa.gov]
Sent:	12/18/2019 3:51:12 PM
To:	Barba, Daniel [Barba.Daniel@epa.gov]; Brusstar, Matt [brusstar.matt@epa.gov]; Bynum, Cheryl [bynum.cheryl@epa.gov]; Choi, David [Choi.David@epa.gov]; Cullen, Angela [cullen.angela@epa.gov]; Duncan, Allen [duncan.allen@epa.gov]; Galano, Fidel [Galano.Fidel@epa.gov]; Geeting, Michael [geeting.michael@epa.gov]; Haley, Mike [Haley.Mike@epa.gov]; Hildreth, Kirk [Hildreth.Kirk@epa.gov]; Hoyer, Marion [hoyer.marion@epa.gov]; Imfeld, Sterling [imfeld.sterling@epa.gov]; Jackson, Cleophas [jackson.cleophas@epa.gov]; Johnson, Dennis [Johnson.Dennis@epa.gov]; Keller, Jennifer [Keller.Jennifer@epa.gov]; Kolowich, Bruce [kolowich.bruce@epa.gov]; Le, Madison [Le.Madison@epa.gov]; Lie, Sharyn [Lie.Sharyn@epa.gov]; Machiele, Paul [machiele.paul@epa.gov]; Moltzen, Michael [Moltzen.Michael@epa.gov]; Nelson, Brian [nelson.brian@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Patulski, Meg [patulski.meg@epa.gov]; Peralta, Maria [Peralta.Maria@epa.gov]; Samulski, Michael [samulski.michael@epa.gov]; Snapp, Lisa [snapp.lisa@epa.gov]; Spieth, John [Spieth.John@epa.gov]; Wehrly, Linc [wehrly.linc@epa.gov]; Weihrauch, John [Weihrauch.John@epa.gov]; Zaremski, Sara [zaremski.sara@epa.gov]; Hengst, Benjamin [Hengst.Benjamin@epa.gov]; Birgfeld, Erin [Birgfeld.Erin@epa.gov]; Haley, Mike [Haley.Mike@epa.gov]; Schenk, Ruth [schenk.ruth@epa.gov]; Watkins, Erica [Watkins.Erica@epa.gov]; Christian, Pamela [Christian.Pamela@epa.gov]
CC:	Reynolds, Christina [Reynolds.ChristinaD@epa.gov]; Hula, Aaron [Hula.Aaron@epa.gov]; Wysor, Tad [wysor.tad@epa.gov]; Moran, Robin [moran.robin@epa.gov]; Bunker, Amy [Bunker.Amy@epa.gov]; Yanca, Catherine [yanca.catherine@epa.gov]; Moskalik, Andrew [Moskalik.Andrew@epa.gov]
Subject:	Electric Vehicle Performance in Hot and Cold Temperatures: Test Planning
Attachments:	2019_12_04_TestingEVs.docx

Attached for your reading pleasure is a 1-pager that captures ideas around parameters of interest for electric vehicle (EV) testing; these ideas were developed as potential additions to an existing test plan for evaluating EV performance in hot and cold temperatures.

Similar to the previous 1-pagers that we've shared with you, this working draft is an output of a cross-division, collaborative team of OTAQ staff who are following trends in new mobility; it reflects our most recent discussion and is intended as a current view into the team's thinking.

Background on this particular 1-pager:

Ex. 5 Deliberative Process (DP)

Ex. 5 Deliberative Process (DP) As always, we're sharing this 1-pager with OTAQ Center Directors for general awareness of our ongoing discussions and thinking in this area. If you would like a copy of any of our previous 1-pagers, then please let us know and we'll be happy to share them.

What's next:
We plan to continue sharing similar, high-level summaries of our team discussions as something to build on in future OTAQ discussions or shared work. We welcome your ideas on other SAEV-related topics to cover in future summaries, or general feedback on this format. We currently have over 30 team members who join our monthly meetings as their calendar allows. If you or members of your center would like to join future discussions, then simply let us know and we'll gladly share the calendar invite.

If you have questions, suggestions, or feedback, please email Christy Parsons, Aaron Hula, or Tad Wysor; we'd also be happy to setup a time to talk in person.

Thanks and Happy Holidays!

The OTAQ SAEV Workgroup

Manufacturer	Model	Lanuch Date
Ex. 5 Deliberative Process (DP)		

Comments

Ex. 5 Deliberative Process (DP)

Rank	Model	YTD	YTD vs LY
1	Ford F-Series	807,379	10.1
2	Chevrolet Silverado	518,188	-0.5
3	Ram P/U	455,816	3.2
4	Toyota RAV4	375,052	19.1
5	Nissan Rogue	363,293	25.5
6	Honda Civic	345,880	3.1
7	Toyota Camry	343,750	-3.2
8	Honda CR-V	340,912	6.7
9	Toyota Corolla	309,227	-10.9
10	Honda Accord	300,540	-3.5
11	Ford Escape	282,043	0.3
12	Chevrolet Equinox	257,674	19.8
13	Ford Explorer	242,565	7
14	Nissan Altima	236,797	-16.2
15	Jeep Grand Cherokee	217,074	14.8
16	Nissan Sentra	201,617	2
17	Toyota Highlander	194,734	17.3
18	Ford Fusion	192,179	-22.1
19	GMC Sierra	191,507	-3.5
20	Toyota Tacoma	179,419	3
21	Hyundai Elantra	176,860	-6.3
22	Jeep Wrangler	176,822	0.4
23	Chevrolet Cruze	171,345	-0.1
24	Subaru Outback	170,638	5.2
25	Chevrolet Malibu	169,229	-17.5
26	Subaru Forester	160,122	-0.3
27	Jeep Cherokee	150,524	-17.9
28	Ford Focus	147,148	-7.2
29	Ford Edge	128,943	5.8
30	Hyundai Sonata	123,295	-33.6
31	Hyundai Santa Fe	120,025	-0.3
32	Dodge Grand Caravan	118,573	-2
33	Toyota 4Runner	116,342	15.8
34	Ford Transit	114,980	-11.6
35	Mazda CX-5	113,466	13.2
36	Chevrolet Traverse	111,193	4.6
37	Kia Forte	109,674	14.6
38	Honda Pilot	108,677	0
39	Volkswagen Jetta	108,575	0.5
40	Kia Soul	108,102	-18.9
41	Chrysler Pacifica	107,130	105.7
42	Subaru Impreza	106,940	32.9
43	Toyota Tundra	105,399	1.4
44	Chevrolet Colorado	103,370	4.1

45	Hyundai Tucson	103,102	27.2
46	Toyota Sienna	102,548	-12.1
47	GMC Acadia	100,439	31.7
48	Kia Optima	100,412	-10.1
49	Nissan Versa	99,647	-19.2
50	Toyota Prius	99,180	-20.1
51	Subaru Crosstrek	97,836	14.5
52	Jeep Renegade	95,892	1.4
53	Lexus RX	94,356	-0.2
54	Kia Sorento	91,944	-10.7
55	Honda Odyssey	90,433	-18.1
56	Chevrolet Tahoe	88,690	-3
57	Honda HR-V	86,491	18.5
58	Dodge Journey	85,243	-12.1
59	Dodge Charger	81,251	-7.9
60	Buick Encore	79,983	13
61	GMC Terrain	78,941	-1.9
62	Nissan Pathfinder	75,012	3.7
63	Jeep Compass	74,510	-13.5
64	Ford Mustang	74,152	-24.9
65	Chevrolet Trax	72,726	2.4
66	Mercedes-Benz C-Class	70,947	1.6
67	Mazda 3	69,349	-20.7
68	Nissan Frontier	68,480	-15.3
69	Chevrolet Impala	67,676	-21.5
70	Kia Sportage	67,239	-10.2
71	Nissan Murano	67,014	-15.2
72	Volkswagen Golf	64,449	22.3
73	Chevrolet Camaro	64,138	-2.4
74	Dodge Durango	63,214	0.9
75	Chevrolet Express	62,868	4.4
76	Nissan Maxima	62,611	9.1
77	Cadillac XT5	61,424	91.7
78	Dodge Challenger	60,029	1.4
79	Volkswagen Passat	57,707	-12.2
80	BMW 3-Series	53,893	-15.4
81	Hyundai Accent	53,750	-28.9
82	Lexus NX	51,931	9.3
83	Chevrolet Suburban	50,728	-3.4
84	Audi Q5	50,109	16.1
85	Acura MDX	48,810	-0.9
86	Mercedes-Benz GLE-Class	48,772	5.5
87	Nissan Titan	47,342	170.8
88	Acura RDX	46,487	0.2
89	Ford Expedition	46,425	-14.9

90	Lexus ES	46,351	-11
91	Honda Fit	46,020	-11.8
92	Mercedes-Benz E / CLS-Class	45,927	-0.3
93	Chrysler 300	45,511	-8.3
94	Subaru Legacy	45,244	-23.8
95	BMW X5	43,968	6.2
96	Ford E-Series	43,393	-12.3
97	Buick Enclave	43,238	-10.3
98	Ford Fiesta	42,592	-5.4
99	Mercedes-Benz GLC-Class	42,491	-3.1
100	Toyota Yaris	42,269	17.1
101	GMC Yukon	40,652	-13.8
102	Jeep Patriot	40,495	-64.5
103	Volkswagen Tiguan	38,922	2.3
104	Ford Taurus	37,842	-5.4
105	Ram ProMaster	37,131	3.9
106	BMW X3	36,408	-7.2
107	Infiniti QX60	36,346	-2.3
108	BMW 4-Series	36,223	12.7
109	BMW 5-Series	35,915	18.6
110	Infiniti Q50	35,156	-8
111	Buick Envision	34,984	240.9
112	Audi Q7	33,508	22.8
113	Audi A4	33,397	2.2
114	Cadillac Escalade	33,242	-1.1
115	Nissan Armada	32,299	179.4
116	Mitsubishi Outlander	32,292	33.9
117	Honda Ridgeline	31,895	62.9
118	Acura TLX	31,745	-5.3
119	Mazda 6	31,626	-24.4
120	Ford Transit Connect	30,500	-21.3
121	Toyota Avalon	30,156	-29.9
122	Mitsubishi Outlander Sport	29,482	-3.5
123	Mercedes-Benz GLS-Class	29,250	7.6
124	Mini Cooper	29,162	-17.7
125	GMC Canyon	28,639	-14.3
126	GMC Yukon XL	28,638	-8.2
127	Chevrolet Sonic	28,344	-42
128	Lincoln MKX	28,055	2.2
129	GMC Savana	27,725	70.2
130	Tesla Model S †	26,400	9.1
131	BMW X1	26,372	11.6
132	Volvo XC90	26,225	-10.2
133	Lincoln MKZ	25,094	-10
134	Kia Niro	24,840	0

135	Lincoln MKC	24,544	7.8
136	Mercedes-Benz Sprinter	24,352	-3.7
137	Lexus GX	23,865	10.1
138	Lexus IS	23,705	-27.9
139	Chevrolet Corvette	22,801	-16.4
140	Mazda CX-9	22,552	67.6
141	Kia Sedona	22,486	-46.8
142	Tesla Model X †	22,000	66.7
143	Toyota C-HR	21,889	0
144	Mercedes-Benz GLA-Class	21,524	-3
145	Mitsubishi Mirage	21,363	3.3
146	Volkswagen Atlas	21,049	0
147	Ford Flex	20,555	5
148	Volvo XC60	20,095	13.7
149	Chevrolet Bolt	20,070	0
150	Porsche Macan	19,985	14
151	Chevrolet Spark	19,510	-37.6
152	Audi A3	18,979	-23.9
153	Buick LaCrosse	18,776	-24.2
154	Chevrolet Volt	18,412	-12.5
155	Mercedes-Benz CLA-Class	18,390	-23.1
156	Audi A5	18,343	136.3
157	Audi Q3	18,266	1.5
158	Chrysler 200	18,125	-66.8
159	Land Rover Range Rover Sport	17,701	-5.9
160	Jaguar F-Pace	17,238	110.4
161	Nissan NV200	17,028	0.3
162	Ford C-Max	16,974	-3.8
163	Nissan NV	16,220	1.8
164	Land Rover Range Rover	15,794	12.9
165	Infiniti QX80	15,365	4.2
166	Kia Rio	15,142	-44.8
167	Infiniti QX50	15,072	0.8
168	Cadillac XTS	15,051	-21
169	Mazda CX-3	14,773	-12.6
170	Genesis G80	14,672	204.9
171	Audi A6	14,334	-14
172	Volkswagen Beetle	14,331	1.8
173	Ram ProMaster City	13,967	-4.5
174	Mercedes-Benz S-Class	13,704	-20.8
175	Mini Countryman	13,323	12.4
176	Infiniti QX30	13,263	773.1
177	Land Rover Discovery Sport	12,721	1.1
178	Porsche Cayenne	12,263	-14.1
179	Mitsubishi Lancer	12,042	-10.4

180	Fiat 500	12,018	-14.3
181	Cadillac ATS	12,007	-37.5
182	Hyundai Veloster	11,903	-56.5
183	Volvo S60	11,358	-10.5
184	Nissan Leaf	11,128	-8.1
185	Toyota Sequoia	11,004	-1.7
186	Acura ILX	10,922	-19.2
187	Mazda MX-5 Miata	10,801	23.7
188	Lincoln Continental	10,796	216
189	Land Rover Range Rover Evoque	10,724	9.4
190	Buick Regal	10,554	-43
191	BMW 2-Series	10,549	-26.9
192	Hyundai Ioniq	10,289	0
193	Dodge Dart	9,943	-76.3
194	Nissan Juke	9,912	-45.8
195	Infiniti Q60	9,882	234.8
196	Cadillac CT6	9,701	23.2
197	Cadillac CTS	9,539	-32.9
198	Lincoln Navigator	9,079	-2.5
199	Jaguar XE	8,571	56
200	Porsche 911	8,197	0.1
201	BMW 7-Series	8,169	-29.6
202	Alfa Romeo Giulia	7,892	112,642.90
203	Volvo S90	7,823	380.2
204	Chevrolet City Express	7,425	18
205	Fiat 500X	6,992	-35.7
206	Lexus GS	6,857	-49.4
207	Infiniti QX70	6,856	32.5
208	Lexus RC	6,677	-34
209	Mercedes-Benz Metris	6,595	28
210	Toyota 86/Scion FR-S	6,421	-6.9
211	Kia Cadenza	6,353	47.4
212	Porsche Panamera	6,276	43.7
213	BMW X6	5,775	-8.7
214	BMW i3	5,604	-18
215	Infiniti Q70	5,366	1.4
216	Land Rover Discovery / LR4	5,360	-48.4
217	Lexus LX	5,260	8
218	Buick Cascada	5,187	-20.5
219	Maserati Ghibli	4,962	-21.9
220	Nissan Quest	4,949	-52.1
221	Maserati Levante	4,883	272.7
222	Lexus CT	4,681	-41
223	BMW X4	4,660	1.5
224	Land Rover Range Rover Velar	4,459	0

225	Volvo V60	4,429	-20.9
226	Audi A7	4,357	-24.2
227	Nissan 370Z	4,310	-22.3
228	Buick Verano	4,224	-85.6
229	Jaguar XF	4,196	-32.1
230	Fiat 124 Spider	4,191	88.4
231	Chevrolet SS	4,013	37.5
232	Genesis G90	3,992	890.6
233	Subaru BRZ	3,834	-2.4
234	Lexus LS	3,788	-22.8
235	Jaguar F-Type	3,717	1
236	Mercedes-Benz G-Class	3,717	6.3
237	Volkswagen Touareg	3,061	-20
238	BMW 6-Series	2,986	-17
239	Hyundai Azera	2,919	-36
240	Smart Fortwo	2,905	-42.2
241	Audi A8	2,861	-21.6
242	Lincoln MKT	2,819	-16.6
243	Toyota Land Cruiser	2,710	-16.6
244	Mercedes-Benz SL-Class	2,663	-22.1
245	Porsche Cayman	2,615	-22.3
246	Audi A3 e-tron	2,607	-29.4
247	Mercedes-Benz SLC-Class	2,600	-15.2
248	Jaguar XJ	2,458	-27.7
249	Lexus LC	2,197	0
250	Porsche Boxster	2,171	-13.9
251	Volvo V90	2,119	0
252	Audi TT	2,057	-26.3
253	Alfa Romeo Stelvio	1,724	0
254	Fiat 500L	1,553	-48.5
255	Toyota Mirai	1,542	68
256	Maserati Quattroporte	1,527	-26.4
257	Mercedes-AMG GT	1,425	26.2
258	Tesla Model 3	1,420	0
259	Volkswagen CC	1,301	-54.6
260	Hyundai Genesis	1,134	-95
261	Acura RLX	1,051	-18.3
262	Honda Clarity FCV	1,030	0
263	Bentley Bentayga	1,003	56
264	Maserati GranTurismo	899	-18.3
265	Bentley Continental GT	797	-21.9
266	Audi R8	716	9.5
267	Honda CR-Z	686	-68.5
268	Chevrolet Caprice PPV	675	-24.7
269	Mercedes-Benz B-Class	633	9.5

270	Dodge Viper	576	0.9
271	Chrysler Town & Country	571	-99
272	Nissan GT-R	542	-16.9
273	Acura NSX	525	161.2
274	BMW Z4	502	-54.9
275	Kia K900	420	-44.3
276	BMW i8	408	-72.1
277	Alfa Romeo 4C	381	-16.6
278	Bentley Flying Spur	218	-40.9
279	Scion tC	197	-97.9
280	Cadillac SRX	155	-99.3
281	Lincoln MKS	153	-96.8
282	Bentley Mulsanne	89	-36.9
283	Ford GT	80	0
284	Hyundai Equus	20	-98.5
285	Cadillac ELR	17	-96.8
286	Kia Stinger	17	0
287	Toyota Venza	14	-97.6
288	Dodge Avenger	12	-73.3
289	Mazda 5	10	-97.3
290	Mini Paceman	9	-89.2
291	Mitsubishi i MiEV	6	-93.4
292	Volvo S80	6	-99
293	Honda Crosstour	5	-99.3
294	Toyota FJ Cruiser	4	-55.6
295	Honda Insight	3	-95.5
296	Lexus LFA	3	-50
297	Scion xD	2	-77.8
298	Nissan Xterra	1	-97.4
299	Volkswagen Eos	1	-99.7
300	Volvo XC60 II		0
301	Volvo XC70		-100

Rank	Model	YTD	YTD vs LY
1	Ford F-Series	807,379	10.1
2	Chevrolet Silverado/Sierra	709,695	-0.5
3	Ram P/U	455,816	3.2
4	Toyota RAV4	375,052	19.1
5	Nissan Rogue	363,293	25.5
6	Honda Civic	345,880	3.1
7	Toyota Camry	343,750	-3.2
8	Honda CR-V	340,912	6.7
9	Chevrolet Equinox/ Terrain	336,615	19.8
10	Toyota Corolla	309,227	-10.9
11	Honda Accord	300,540	-3.5
12	Hyundai Elantra/Forte	286,534	-6.3
13	Ford Escape	282,043	0.3
14	Ford Explorer	242,565	7
15	Nissan Altima	236,797	-16.2
16	Dodge Grand Caravan/Pacifica	225,703	-2
17	Hyundai Sonata/ Optima	223,707	-33.6
18	Ford Fusion/MKZ	217,273	-22.1
19	Jeep Grand Cherokee	217,074	14.8
32	Hyundai Santa Fe/ Sorento	211,969	-0.3
20	Chevrolet Traverse/ Acadia	211,632	4.6
21	Nissan Sentra	201,617	2
22	Toyota Highlander	194,734	17.3
23	Toyota Tacoma	179,419	3
24	Jeep Wrangler	176,822	0.4
25	Chevrolet Cruze	171,345	-0.1
26	Subaru Outback	170,638	5.2
42	Hyundai Tucson/Sportage	170,341	27.2
27	Chevrolet Malibu	169,229	-17.5
28	Subaru Forester	160,122	-0.3
29	Jeep Cherokee	150,524	-17.9
30	Ford Focus	147,148	-7.2
31	Ford Edge	128,943	5.8
33	Toyota 4Runner	116,342	15.8
34	Ford Transit	114,980	-11.6
35	Mazda CX-5	113,466	13.2
36	Honda Pilot	108,677	0
37	Volkswagen Jetta	108,575	0.5
38	Kia Soul	108,102	-18.9
39	Subaru Impreza	106,940	32.9
40	Toyota Tundra	105,399	1.4
41	Chevrolet Colorado	103,370	4.1
43	Toyota Sienna	102,548	-12.1
44	Nissan Versa	99,647	-19.2
45	Toyota Prius	99,180	-20.1
46	Subaru Crosstrek	97,836	14.5

47	Jeep Renegade	95,892	1.4
48	Lexus RX	94,356	-0.2
50	Honda Odyssey	90,433	-18.1
51	Chevrolet Tahoe	88,690	-3
52	Honda HR-V	86,491	18.5
53	Dodge Journey	85,243	-12.1
54	Dodge Charger	81,251	-7.9
55	Buick Encore	79,983	13
56	Nissan Pathfinder	75,012	3.7
57	Jeep Compass	74,510	-13.5
58	Ford Mustang	74,152	-24.9
59	Chevrolet Trax	72,726	2.4
60	Mercedes-Benz C-Class	70,947	1.6
61	Mazda 3	69,349	-20.7
62	Nissan Frontier	68,480	-15.3
63	Chevrolet Impala	67,676	-21.5
65	Nissan Murano	67,014	-15.2
66	Volkswagen Golf	64,449	22.3
67	Chevrolet Camaro	64,138	-2.4
68	Dodge Durango	63,214	0.9
69	Chevrolet Express	62,868	4.4
70	Nissan Maxima	62,611	9.1
71	Cadillac XT5	61,424	91.7
72	Dodge Challenger	60,029	1.4
73	Volkswagen Passat	57,707	-12.2
74	BMW 3-Series	53,893	-15.4
75	Hyundai Accent	53,750	-28.9
76	Lexus NX	51,931	9.3
77	Chevrolet Suburban	50,728	-3.4
78	Audi Q5	50,109	16.1
79	Acura MDX	48,810	-0.9
80	Mercedes-Benz GLE-Class	48,772	5.5
81	Nissan Titan	47,342	170.8
82	Acura RDX	46,487	0.2
83	Ford Expedition	46,425	-14.9
84	Lexus ES	46,351	-11
85	Honda Fit	46,020	-11.8
86	Mercedes-Benz E / CLS-Class	45,927	-0.3
87	Chrysler 300	45,511	-8.3
88	Subaru Legacy	45,244	-23.8
89	BMW X5	43,968	6.2
90	Ford E-Series	43,393	-12.3
91	Buick Enclave	43,238	-10.3
92	Ford Fiesta	42,592	-5.4
93	Mercedes-Benz GLC-Class	42,491	-3.1
94	Toyota Yaris	42,269	17.1
95	GMC Yukon	40,652	-13.8

96	Jeep Patriot	40,495	-64.5
97	Volkswagen Tiguan	38,922	2.3
98	Ford Taurus	37,842	-5.4
99	Ram ProMaster	37,131	3.9
100	BMW X3	36,408	-7.2
101	Infiniti QX60	36,346	-2.3
102	BMW 4-Series	36,223	12.7
103	BMW 5-Series	35,915	18.6
104	Infiniti Q50	35,156	-8
105	Buick Envision	34,984	240.9
106	Audi Q7	33,508	22.8
107	Audi A4	33,397	2.2
108	Cadillac Escalade	33,242	-1.1
109	Nissan Armada	32,299	179.4
110	Mitsubishi Outlander	32,292	33.9
111	Honda Ridgeline	31,895	62.9
112	Acura TLX	31,745	-5.3
113	Mazda 6	31,626	-24.4
114	Ford Transit Connect	30,500	-21.3
115	Toyota Avalon	30,156	-29.9
116	Mitsubishi Outlander Sport	29,482	-3.5
117	Mercedes-Benz GLS-Class	29,250	7.6
118	Mini Cooper	29,162	-17.7
119	GMC Canyon	28,639	-14.3
120	GMC Yukon XL	28,638	-8.2
121	Chevrolet Sonic	28,344	-42
122	Lincoln MKX	28,055	2.2
123	GMC Savana	27,725	70.2
124	Tesla Model S †	26,400	9.1
125	BMW X1	26,372	11.6
126	Volvo XC90	26,225	-10.2
127	Lincoln MKZ	25,094	-10
128	Kia Niro	24,840	0
129	Lincoln MKC	24,544	7.8
130	Mercedes-Benz Sprinter	24,352	-3.7
131	Lexus GX	23,865	10.1
132	Lexus IS	23,705	-27.9
133	Chevrolet Corvette	22,801	-16.4
134	Mazda CX-9	22,552	67.6
135	Kia Sedona	22,486	-46.8
136	Tesla Model X †	22,000	66.7
137	Toyota C-HR	21,889	0
138	Mercedes-Benz GLA-Class	21,524	-3
139	Mitsubishi Mirage	21,363	3.3
140	Volkswagen Atlas	21,049	0
141	Ford Flex	20,555	5
142	Volvo XC60	20,095	13.7

143	Chevrolet Bolt	20,070	0
144	Porsche Macan	19,985	14
145	Chevrolet Spark	19,510	-37.6
146	Audi A3	18,979	-23.9
147	Buick LaCrosse	18,776	-24.2
148	Chevrolet Volt	18,412	-12.5
149	Mercedes-Benz CLA-Class	18,390	-23.1
150	Audi A5	18,343	136.3
151	Audi Q3	18,266	1.5
152	Chrysler 200	18,125	-66.8
153	Land Rover Range Rover Sport	17,701	-5.9
154	Jaguar F-Pace	17,238	110.4
155	Nissan NV200	17,028	0.3
156	Ford C-Max	16,974	-3.8
157	Nissan NV	16,220	1.8
158	Land Rover Range Rover	15,794	12.9
159	Infiniti QX80	15,365	4.2
160	Kia Rio	15,142	-44.8
161	Infiniti QX50	15,072	0.8
162	Cadillac XTS	15,051	-21
163	Mazda CX-3	14,773	-12.6
164	Genesis G80	14,672	204.9
165	Audi A6	14,334	-14
166	Volkswagen Beetle	14,331	1.8
167	Ram ProMaster City	13,967	-4.5
168	Mercedes-Benz S-Class	13,704	-20.8
169	Mini Countryman	13,323	12.4
170	Infiniti QX30	13,263	773.1
171	Land Rover Discovery Sport	12,721	1.1
172	Porsche Cayenne	12,263	-14.1
173	Mitsubishi Lancer	12,042	-10.4
174	Fiat 500	12,018	-14.3
175	Cadillac ATS	12,007	-37.5
176	Hyundai Veloster	11,903	-56.5
177	Volvo S60	11,358	-10.5
178	Nissan Leaf	11,128	-8.1
179	Toyota Sequoia	11,004	-1.7
180	Acura ILX	10,922	-19.2
181	Mazda MX-5 Miata	10,801	23.7
182	Lincoln Continental	10,796	216
183	Land Rover Range Rover Evoque	10,724	9.4
184	Buick Regal	10,554	-43
185	BMW 2-Series	10,549	-26.9
186	Hyundai Ioniq	10,289	0
187	Dodge Dart	9,943	-76.3
188	Nissan Juke	9,912	-45.8
189	Infiniti Q60	9,882	234.8

190	Cadillac CT6	9,701	23.2
191	Cadillac CTS	9,539	-32.9
192	Lincoln Navigator	9,079	-2.5
193	Jaguar XE	8,571	56
194	Porsche 911	8,197	0.1
195	BMW 7-Series	8,169	-29.6
196	Alfa Romeo Giulia	7,892	112,642.90
197	Volvo S90	7,823	380.2
198	Chevrolet City Express	7,425	18
199	Fiat 500X	6,992	-35.7
200	Lexus GS	6,857	-49.4
201	Infiniti QX70	6,856	32.5
202	Lexus RC	6,677	-34
203	Mercedes-Benz Metris	6,595	28
204	Toyota 86/Scion FR-S	6,421	-6.9
205	Kia Cadenza	6,353	47.4
206	Porsche Panamera	6,276	43.7
207	BMW X6	5,775	-8.7
208	BMW i3	5,604	-18
209	Infiniti Q70	5,366	1.4
210	Land Rover Discovery / LR4	5,360	-48.4
211	Lexus LX	5,260	8
212	Buick Cascada	5,187	-20.5
213	Maserati Ghibli	4,962	-21.9
214	Nissan Quest	4,949	-52.1
215	Maserati Levante	4,883	272.7
216	Lexus CT	4,681	-41
217	BMW X4	4,660	1.5
218	Land Rover Range Rover Velar	4,459	0
219	Volvo V60	4,429	-20.9
220	Audi A7	4,357	-24.2
221	Nissan 370Z	4,310	-22.3
222	Buick Verano	4,224	-85.6
223	Jaguar XF	4,196	-32.1
224	Fiat 124 Spider	4,191	88.4
225	Chevrolet SS	4,013	37.5
226	Genesis G90	3,992	890.6
227	Subaru BRZ	3,834	-2.4
228	Lexus LS	3,788	-22.8
229	Jaguar F-Type	3,717	1
230	Mercedes-Benz G-Class	3,717	6.3
231	Volkswagen Touareg	3,061	-20
232	BMW 6-Series	2,986	-17
233	Hyundai Azera	2,919	-36
234	Smart Fortwo	2,905	-42.2
235	Audi A8	2,861	-21.6
236	Lincoln MKT	2,819	-16.6

237	Toyota Land Cruiser	2,710	-16.6
238	Mercedes-Benz SL-Class	2,663	-22.1
239	Porsche Cayman	2,615	-22.3
240	Audi A3 e-tron	2,607	-29.4
241	Mercedes-Benz SLC-Class	2,600	-15.2
242	Jaguar XJ	2,458	-27.7
243	Lexus LC	2,197	0
244	Porsche Boxster	2,171	-13.9
245	Volvo V90	2,119	0
246	Audi TT	2,057	-26.3
247	Alfa Romeo Stelvio	1,724	0
248	Fiat 500L	1,553	-48.5
249	Toyota Mirai	1,542	68
250	Maserati Quattroporte	1,527	-26.4
251	Mercedes-AMG GT	1,425	26.2
252	Tesla Model 3	1,420	0
253	Volkswagen CC	1,301	-54.6
254	Hyundai Genesis	1,134	-95
255	Acura RLX	1,051	-18.3
256	Honda Clarity FCV	1,030	0
257	Bentley Bentayga	1,003	56
258	Maserati GranTurismo	899	-18.3
259	Bentley Continental GT	797	-21.9
260	Audi R8	716	9.5
261	Honda CR-Z	686	-68.5
262	Chevrolet Caprice PPV	675	-24.7
263	Mercedes-Benz B-Class	633	9.5
264	Dodge Viper	576	0.9
265	Chrysler Town & Country	571	-99
266	Nissan GT-R	542	-16.9
267	Acura NSX	525	161.2
268	BMW Z4	502	-54.9
269	Kia K900	420	-44.3
270	BMW i8	408	-72.1
271	Alfa Romeo 4C	381	-16.6
272	Bentley Flying Spur	218	-40.9
273	Scion tC	197	-97.9
274	Cadillac SRX	155	-99.3
275	Lincoln MKS	153	-96.8
276	Bentley Mulsanne	89	-36.9
277	Ford GT	80	0
278	Hyundai Equus	20	-98.5
279	Cadillac ELR	17	-96.8
280	Kia Stinger	17	0
281	Toyota Venza	14	-97.6
282	Dodge Avenger	12	-73.3
283	Mazda 5	10	-97.3

284	Mini Paceman	9	-89.2
285	Mitsubishi i MiEV	6	-93.4
286	Volvo S80	6	-99
287	Honda Crosstour	5	-99.3
288	Toyota FJ Cruiser	4	-55.6
289	Honda Insight	3	-95.5
290	Lexus LFA	3	-50
291	Scion xD	2	-77.8
292	Nissan Xterra	1	-97.4
293	Volkswagen Eos	1	-99.7
294	Volvo XC60 II		0
295	Volvo XC70		-100

Message

From: Brusstar, Matt [brusstar.matt@epa.gov]
Sent: 12/19/2017 3:10:43 PM
To: Moskalik, Andrew [Moskalik.Andrew@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]; Dalton, Joel [Dalton.Joel@epa.gov]; Fernandez, Antonio [fernandez.antonio@epa.gov]; Barba, Daniel [Barba.Daniel@epa.gov]; Peralta, Maria [Peralta.Maria@epa.gov]; Wehrly, Linc [wehrly.linc@epa.gov]; Wright, DavidA [Wright.DavidA@epa.gov]; Snapp, Lisa [snapp.lisa@epa.gov]; Ellies, Ben [ellies.ben@epa.gov]; Cullen, Angela [cullen.angela@epa.gov]; Kargul, John [kargul.john@epa.gov]; Safoutin, Mike [safoutin.mike@epa.gov]; Bunker, Amy [Bunker.Amy@epa.gov]; Hula, Aaron [Hula.Aaron@epa.gov]; Wysor, Tad [wysor.tad@epa.gov]; Yanca, Catherine [yanca.catherine@epa.gov]
Subject: Future Vision: Question Summary
Attachments: Question Summary.pptx

All—
As a follow-up to our "Future Vision of Vehicle Testing" discussions last Fall, Andy has distilled the meeting notes down into an organized set of issues/questions. In the next couple weeks, we will be assembling a story based on these materials in the form of an SLT Salon Topic whitepaper, for discussion in mid-January.

Can you please provide feedback on the attached meeting summary, on whether you believe the ideas are captured appropriately and reasonably completely by the questions posed? In the meantime, we will be circulating the whitepaper document as it comes together, shortly after the holidays.

Happy holidays,
Matt

Message

From: Wright, DavidA [Wright.DavidA@epa.gov]
Sent: 1/24/2018 10:16:07 PM
To: Wehrly, Linc [wehrly.linc@epa.gov]
CC: Fernandez, Antonio [fernandez.antonio@epa.gov]; Dalton, Joel [Dalton.Joel@epa.gov]
Subject: FW: Future Vision: Question Summary
Attachments: Future-Vision-Vehicle-Testing-Whitepaper-draft.docx

Linc,

According to Matt in his appended note the first four pages of the appended document will be presented to the SLT at the end of this month. Ex. 5 Deliberative Process (DP)
Ex. 5 Deliberative Process (DP) On page 2 in the section titled today's vehicles the first bullet includes the following –

Ex. 5 Deliberative Process (DP)

If you haven't read through this, you might want to take a look I would be interested in getting your thoughts before the time frame for providing comments to Matt has ended and the draft goes to the SLT.

Regards,

David

From: Brusstar, Matt
Sent: Tuesday, January 23, 2018 5:10 PM
To: Moskalik, Andrew <Moskalik.Andrew@epa.gov>; Olechiw, Michael <olechiw.michael@epa.gov>; Dalton, Joel <Dalton.Joel@epa.gov>; Fernandez, Antonio <fernandez.antonio@epa.gov>; Barba, Daniel <Barba.Daniel@epa.gov>; Peralta, Maria <Peralta.Maria@epa.gov>; Wehrly, Linc <wehrly.linc@epa.gov>; Wright, DavidA <Wright.DavidA@epa.gov>; Snapp, Lisa <snapp.lisa@epa.gov>; Ellies, Ben <ellies.ben@epa.gov>; Cullen, Angela <cullen.angela@epa.gov>; Kargul, John <kargul.john@epa.gov>; Safoutin, Mike <safoutin.mike@epa.gov>; Bunker, Amy <Bunker.Amy@epa.gov>; Hula, Aaron <Hula.Aaron@epa.gov>; Wysor, Tad <wysor.tad@epa.gov>; Yanca, Catherine <yanca.catherine@epa.gov>
Subject: RE: Future Vision: Question Summary

Attached is a short whitepaper that we've composed, distilled from our discussions a few months ago. The attachment also includes appendix material that gives a more detailed list of questions that the whitepaper is based on. The intent is not to present the appendix to the SLT, but pass it along as supplemental information, while keeping the focus on the main message in the 4-pager.

At this point, we are expecting to present this to SLT on January 31. If you could please review and offer any comments by COB this Thursday (1/25), I incorporate your suggested changes in the final document on Friday.

Thanks,
Matt

From: Brusstar, Matt
Sent: Tuesday, December 19, 2017 10:11 AM
To: Moskalik, Andrew <Moskalik.Andrew@epa.gov>; Olechiw, Michael <olechiw.michael@epa.gov>; Dalton, Joel <dalton.joel@epa.gov>; Fernandez, Antonio <fernandez.antonio@epa.gov>; Barba, Daniel <barba.daniel@epa.gov>; Peralta, Maria <Peralta.Maria@epa.gov>; Wehrly, Linc <wehrly.linc@epa.gov>; Wright, DavidA <Wright.DavidA@epa.gov>; Snapp, Lisa <snapp.lisa@epa.gov>; Ellies, Ben <ellies.ben@epa.gov>; Cullen, Angela <cullen.angela@epa.gov>; Kargul, John <kargul.john@epa.gov>; Safoutin, Mike <safoutin.mike@epa.gov>; Amy Bunker <Bunker.Amy@epa.gov>; Hula, Aaron <Hula.Aaron@epa.gov>; Tad Wysor <Wysor.Tad@epa.gov>; Yanca, Catherine <yanca.catherine@epa.gov>
Subject: Future Vision: Question Summary

All—
As a follow-up to our "Future Vision of Vehicle Testing" discussions last Fall, Andy has distilled the meeting notes down into an organized set of issues/questions. In the next couple weeks, we will be assembling a story based on these materials in the form of an SLT Salon Topic whitepaper, for discussion in mid-January.

Can you please provide feedback on the attached meeting summary, on whether you believe the ideas are captured appropriately and reasonably completely by the questions posed? In the meantime, we will be circulating the whitepaper document as it comes together, shortly after the holidays.

Happy holidays,
Matt

Message

From: Danzeisen, Karen [Danzeisen.Karen@epa.gov]
Sent: 2/27/2020 7:05:45 PM
To: Cullen, Daniel [Cullen.Daniel@epa.gov]; Ball, Joel [ball.joel@epa.gov]; Wright, DavidA [Wright.DavidA@epa.gov]
CC: Yang, Ching-Shih [Yang.Ching-Shih@epa.gov]
Subject: All selected EPA Confirmatory Test vehicle info
Attachments: CTDI all selected test vehicles - test procedures - cullen.xlsx; CTDI all selected test vehicles - test procedures-cullen.sql

As per our meeting a few days ago I have created a query to select all the CTDI submissions which were selected by EPA to test at our lab. I sorted it from most recent to least and included all the data so you can make the cut-off where you'd like.

Let me know if you'd like me to change anything.

(Ching-Shih, the SQL is attached.)

Karen

Karen E. Danzeisen
Information Technology Specialist
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

danzeisen.karen@epa.gov
(734)214-4444
https://www.epa.gov/vehicle-and-engine-certification

Appointment

From: Safoutin, Mike [safoutin.mike@epa.gov]
Sent: 9/14/2020 2:14:11 PM
To: Olechiw, Michael [olechiw.michael@epa.gov]; Cherry, Jeff [Cherry.Jeff@epa.gov]; Moskalik, Andrew [Moskalik.Andrew@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Moran, Robin [moran.robin@epa.gov]; Lee, Soduk [Lee.Soduk@epa.gov]; Ellies, Ben [ellies.ben@epa.gov]; McDonald, Joseph [McDonald.Joseph@epa.gov]; Jackman, Dana [jackman.dana@epa.gov]; Neam, Anthony [Neam.Anthony@epa.gov]; Cleveland, Meredith [Cleveland.Meredith@epa.gov]; Burke, Susan [Burke.Susan@epa.gov]; Lie, Sharyn [Lie.Sharyn@epa.gov]; Sherwood, Todd [sherwood.todd@epa.gov]; Sobel, Aaron [Sobel.Aaron@epa.gov]
CC: Barba, Daniel [Barba.Daniel@epa.gov]; Reynolds, Christina [Reynolds.ChristinaD@epa.gov]; Wright, DavidA [Wright.DavidA@epa.gov]; Fernandez, Antonio [fernandez.antonio@epa.gov]; Ramig, Christopher [Ramig.Christopher@epa.gov]

Subject: EV Tech Team Kickoff (one time)
Attachments: EV Tech Team Topics-DRAFT.docx
Location: Microsoft Teams Meeting

Start: 9/14/2020 5:00:00 PM
End: 9/14/2020 6:00:00 PM
Show Time As: Tentative

Required Attendees: Olechiw, Michael; Cherry, Jeff; Moskalik, Andrew; Bolon, Kevin; Moran, Robin; Lee, Soduk; Ellies, Ben; McDonald, Joseph; Jackman, Dana; Neam, Anthony; Cleveland, Meredith; Burke, Susan; Lie, Sharyn; Sherwood, Todd; Sobel, Aaron
Optional Attendees: Barba, Daniel; Reynolds, Christina; Wright, DavidA; Fernandez, Antonio; Ramig, Christopher

Attached – Draft EV Tech Team topics list. Please edit the copy at the Teams site at the following link. See you at 1

https://teams.microsoft.com/_#/files/EV%20Technology%20Team?threadId=19%3A1783d80150b54e3b9c5b4e2896a34db9%40thread.skype&ctx=channel&context=EV%2520Technology%2520Team&rootfolder=%252Fsites%252FSAFE_Vehicles_Rule%252FShared%2520Documents%252FEV%2520Technology%2520Team

This is a single, non-recurring meeting to kick off the EV Tech Team series. We will go through the list of EV tech topics, add any other topics, and identify leads for each.

After this meeting, the EV Tech Team biweekly Tuesday@1:00 series will begin the following week on Tuesday the 22nd.

Join Microsoft Teams Meeting

Ex. 6 Personal Privacy (PP)

s, Washington DC (Toll)

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Message

From: Reynolds, Christina [Reynolds.ChristinaD@epa.gov]
Sent: 12/6/2019 7:53:13 PM
To: Parsons, Christy [Parsons.Christy@epa.gov]; Hula, Aaron [Hula.Aaron@epa.gov]; Bunker, Amy [Bunker.Amy@epa.gov]; Maguire, Andrea [Maguire.Andrea@epa.gov]; Moskalik, Andrew [Moskalik.Andrew@epa.gov]; Wright, DavidA [Wright.DavidA@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Moran, Robin [moran.robin@epa.gov]; Wysor, Tad [wysor.tad@epa.gov]; Beardsley, Megan [Beardsley.Megan@epa.gov]; Doorlag, Mark [doorlag.mark@epa.gov]; Snapp, Lisa [snapp.lisa@epa.gov]; Lie, Sharyn [Lie.Sharyn@epa.gov]; Cullen, Angela [cullen.angela@epa.gov]; Brusstar, Matt [brusstar.matt@epa.gov]; Jackman, Dana [jackman.dana@epa.gov]; Choi, David [Choi.David@epa.gov]; Mo, Tiffany (Na) [mo.na@epa.gov]; Hoyer, Marion [hoyer.marion@epa.gov]; Miller, Elizabeth [Miller.Elizabeth@epa.gov]; Graff, Michelle [graff.michelle@epa.gov]; Daniels, Jessica [daniels.jessica@epa.gov]; Galperin, Diana [Galperin.Diana@epa.gov]; Helfand, Gloria [helfand.gloria@epa.gov]; Kenausis, Kristin [Kenausis.Kristin@epa.gov]; Sobel, Aaron [Sobel.Aaron@epa.gov]; Burkholder, Dallas [burkholder.dallas@epa.gov]; Cleveland, Meredith [Cleveland.Meredith@epa.gov]; Howe, Miranda [howe.miranda@epa.gov]; Peralta, Maria [Peralta.Maria@epa.gov]; Coryell, Mark [coryell.mark@epa.gov]; Cherry, Jeff [Cherry.Jeff@epa.gov]; McBryde, Dan [mcbryde.dan@epa.gov]; Olechiw, Michael [olechiw.michael@epa.gov]
CC: Noyce, Christian [noyce.christian@epa.gov]; Yanca, Catherine [yanca.catherine@epa.gov]; Swisz-Hall, Naima [swisz-hall.naima@epa.gov]; Shell, Michael [Shell.Michael@epa.gov]; Kochunas, Kathryn [kochunas.kathryn@epa.gov]; George, Steve [george.steve@epa.gov]; Spieth, John [Spieth.John@epa.gov]; Burke, Susan [Burke.Susan@epa.gov]
Subject: OTAQ SAEV Draft 1-pager on EV Testing
Attachments: 2019_12_04_TestingEVs.docx

Hi Team-

Attached is a draft 1-pager (also available on Teams) that summarizes our discussion on possible extensions to TATD's existing EV benchmarking project.

Thanks to Matt, Andy, and Cay for their first-line review. I welcome all comments and suggestions – please send to me by COB Monday, 16 Dec.

Cheers,
Christina

.....
Christina Reynolds, Ph.D.
ORISE Research Fellow
EPA National Vehicle & Fuel Emissions Lab
Office: 734.214.4689 Cell: Ex. 6 Personal Privacy (PP)

Message

From: Safoutin, Mike [safoutin.mike@epa.gov]
Sent: 12/15/2020 5:38:03 PM
To: Olechiw, Michael [olechiw.michael@epa.gov]; Cherry, Jeff [Cherry.Jeff@epa.gov]; Moskalik, Andrew [Moskalik.Andrew@epa.gov]; Bolon, Kevin [Bolon.Kevin@epa.gov]; Moran, Robin [moran.robin@epa.gov]; Lee, Soduk [Lee.Soduk@epa.gov]; Ellies, Ben [ellies.ben@epa.gov]; McDonald, Joseph [mcdonald.joseph@epa.gov]; Jackman, Dana [jackman.dana@epa.gov]; Neam, Anthony [Neam.Anthony@epa.gov]; Cleveland, Meredith [Cleveland.Meredith@epa.gov]; Burke, Susan [Burke.Susan@epa.gov]; Lie, Sharyn [Lie.Sharyn@epa.gov]; Sherwood, Todd [sherwood.todd@epa.gov]; Sobel, Aaron [Sobel.Aaron@epa.gov]; McBryde, Dan [mcbryde.dan@epa.gov]; Ludlam, Scott [Ludlam.Scott@epa.gov]; Brown, Jarrod [Brown.Jarrod@epa.gov]; Snapp, Lisa [snapp.lisa@epa.gov]
CC: Barba, Daniel [barba.daniel@epa.gov]; Reynolds, Christina [Reynolds.ChristinaD@epa.gov]; Wright, DavidA [Wright.DavidA@epa.gov]; Fernandez, Antonio [fernandez.antonio@epa.gov]; Ramig, Christopher [Ramig.Christopher@epa.gov]; Wysor, Tad [wysor.tad@epa.gov]; Yanca, Catherine [yanca.catherine@epa.gov]; Doorlag, Mark [doorlag.mark@epa.gov]; Borgert, Kyle [borgert.kyle@epa.gov]
Subject: FYI EV Tech Team - EV costing plan presented to Bill on 12/14
Attachments: Two pager on EV costing plan_v3.docx

Hello everyone,

Just wanted to share a copy of the plan we presented to Bill on Monday for updating our EV costs. We will not go over this document in the 1:00 meeting, but it gives some additional context on the preliminary cost work we will be sharing today.

_____
Michael J. Safoutin, Ph.D.
Mechanical Engineer
Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency
2000 Traverwood Drive, Ann Arbor, MI 48105
(734) 214-4348
Safoutin.Mike@epa.gov

Appointment

From: Herbolsheimer, Courtney [herbolsheimer.courtney@epa.gov]
Sent: 2/25/2020 10:00:26 PM
To: Herbolsheimer, Courtney [herbolsheimer.courtney@epa.gov]; Kenausis, Kristin [Kenausis.Kristin@epa.gov]; Graff, Michelle [graff.michelle@epa.gov]; French, Roberts [french.roberts@epa.gov]; Wright, DavidA [Wright.DavidA@epa.gov]

Subject: EV Fuel Economy Content for the Web
Attachments: EV Fuel Economy Inquiries and Responses.docx
Location: DCRoomARN6520S/DC-OAR-OTAQ-CD; AA-Room-Office-N120-VideoRoom/AA-OTAQ-OFFICE

Start: 3/2/2020 4:00:00 PM
End: 3/2/2020 5:00:00 PM
Show Time As: Busy

Required Attendees: Kenausis, Kristin; Graff, Michelle; French, Roberts; Wright, DavidA

Hi Everyone,

Thanks to you all for your willingness to spend some time together talking about options for adding more technical EV content to the web. Based on recent public inquiries, I think we could start with EV testing procedures for calculating range and fuel economy. I'm attaching a table of recent inquiries with Rob's responses that might help guide content development. This meeting will also be a good time to discuss where to put this content (OTAQ webpage on fuel economy, vehicle testing page, etc.) and how to link to those pages on the new OTAQ "Contact Us" page that I'm trying to develop.

Let me know if you have anything to add, and thanks again!

Courtney

David and Rob work -

Trends report document description describing EV testing

EV testing 1 page summary

EV label calculation 1 page summary

Electric Vehicle Fuel Economy Inquiries and Responses

Inquiry	Response
I understand the 5 tests and how the combined are done for the ICE vehicles. Are you still testing all EVs directly in Ann Arbor lab, eg not using mfg submitted numbers which are selectively verified ? Is this document still how EVs are tested, as indicated on your website : [HYPERLINK "https://www.fueleconomy.gov/feg/pdfs/EPA%20test%20procedure%20for%20EVs-PHEVs-11-14-2017.pdf"] The recent release of the Porsche Taycan and it's roughly 200 mile rating compared to what people are seeing in real world driving are so different it begs as to what method and specifics caused it to produce such a low testing number compared to some of the Tesla numbers (?) Appreciate a link to whatever documents what testing method was used on them, and if there's a database that's freely available to peruse of what was submitted from them.	**Ex. 5 Deliberative Process (DP)**
I have a question about the justification for scaling factors used for Electric Vehicles when converting the 2-cycle results to the 5-cycle equivalent result. From looking at the EPA datafile, I noticed that the Tesla Model 3 Performance 18" uses a scaling factor of 0.7032. On the other extreme, the Tesla Model Y Performance uses a scaling factor of 0.756. Nearly all the other EVs in the 2020 EPA Datafile use a scaling factor of 0.7. What allows Tesla to use such a different scaling factor? This is a 7% difference, and it results in range and efficiency numbers that are 7% higher than they would be with a scaling factor of 0.7032. How is this scaling factor modification justified? What specific factors in the case of Model	

Y are taken into account to justify the reduced scaling of the dyno results to real world results? Finally, why are EVs not required to just run the 5-cycle test? It seems like the 5-cycle test is a very reasonable real-world test and I don't understand why an EV would not be required to test to that standard. It would encourage better efficiency in winter, etc. Finally, why are losses when the car is in standby (often referred to as vampire drain) not regulated by the EPA? For many EVs, and certainly for Tesla, these losses can be significant. Why can they not be measured and included in the EPA efficiency results?	
I'm able to find some excellent information about EPA fuel estimates on epa.gov and fuel economy.gov. However, I'm having a hard time finding the same kind of information about fully electric vehicles. For example, is range estimate testing initially done by the EPA or the vehicle manufacturer? If the latter, does the EPA follow up to confirm the members?	**Ex. 5 Deliberative Process (DP)**
Hi, on your Web site it says the range listed on an EV label is a combination of highway and city driving. Is there a test standard that is available to see the tests run on how the	

results are calculated? I see the variety of tests that are run but I don't see how it is all combined for the range value listed on the label.

Ex. 5 Deliberative Process (DP)

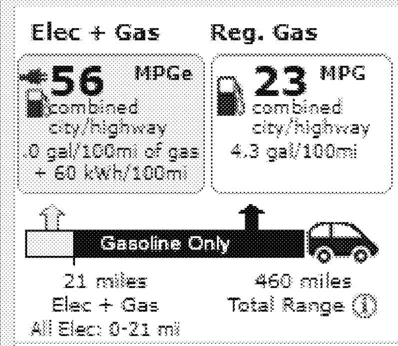
The Honda Clarity Plug-in Hybrid Touring model which I just purchased has an advertised EPA all electric EV driving range rating of 47 miles.

Having worked on an electric car development program at the Ford Motor Scientific Research Staff in the past (1967 +) and holding BSEE and MSEE electical engineering degrees, I am aware that the in the past, the EV driving profile was specified in vehicle speed, starts & stops per mile, roadway slope, acceleration/braking rates and other energy consumption factors which impact the total, all electric range rating for an electric vehicle.

Ex. 5 Deliberative Process (DP)

The Honda Clarity Plug-in Hybrid that I recently purchased has a advertised EPA EV range rating of 47 miles for a fully charged, high voltage, electric drive battery. I would like to know the specifics of the driving profile which is the basis for the EPA's EV range rating for this vehicle.	Ex. 5 Deliberative Process (DP)
I have had some trouble finding a few answers on the EPA website. I have a couple of questions about how MPG-E relates to overall range. The vehicle for this question is the 2020 Lincoln Aviator Grand Touring plug-in hybrid. News reports indicate a gas-only fuel economy of 23 mpg, an electric range of 21 miles, and combined electric and gas mpg-e of 56. This vehicle has a fuel tank of 18 gallons. Does that mean the vehicle range with a full gas tank and full electric charge has a range of 56 mpg-e multiplied by the 18 gallon tank? Or, does your testing indicate that the battery will drain prior to the fuel tank? If so, what was that distance covered prior to the gas-only takeover?	

with a fully charged battery and a full tank of 460 miles.



Recently the Porsche Taycan got an EPA range of 201 miles. I thought that was odd.

Then I saw news stories about them hiring a third party to conduct "real world ranges" which they then proceeded to publish in the same articles as the EPA 5 cycle results.

To quote "Porsche has already done independent testing to try and improve the Taycan Turbo's reputation. Porsche got AMCI testing to determine its own range estimates in various simulated real-world environments. The result was an estimated range of 275 miles" .

That got me to dig further. I'm a numbers and statistics type of guy.
There's something off with the EPA and WLTP for at least two of the VW group products, the e-tron and the Taycan. What I should say is that

Why do I say this? Well, I compared 6 EVs currently on the road (Model 3, X, S, Bolt, Kona, and Niro EV) which have both a WLTP and EPA range rating. The have an average difference of 8% (EPA lower than the WLTP) with a standard deviation of 6.26%.

So now looking at the Audi etron- the WLTP is 259 mi and the EPA is 204 mi- that would be off by 27%. Maybe one data point, it can happen

Ex. 5 Deliberative Process (DP)

Then I looked at the Porsche Taycan- WLTP 279 mi, EPA 201 mi- a difference of 39%. I don't know why the WLTP is so high and the EPA so low, could they have optimized the code and car for the WLTP and then not cared about the EPA range? I don't have access to either of those cars, but what I do know is that the discrepancy between the EPA and WLTP falls outside the 99.7% confidence limit for the etron and the Taycan is almost at the 5 sigma level (99.997%)	Ex. 5 Deliberative Process (DP)
i have a question about the calculation of ranges and consumption for electric vehicles. The WLTP measures cars with the smallest and highest equipment. This results in a range of 381 to 450 kilometres as with the Porsche Taycan. In the EPA cycle, the Taycan achieves 324 kilometers (201 miles). How is the EPA cycle measured? Does the highest equipment apply here? Or is measurement carried out with the smallest basic variant?	

I own Tesla model 3 (2019). EPA mileage ratings have been an important factor in my decision in buying my Tesla. For the benefit of future users, I would like you to caution how cold weather impacts electric cars much more. My kWh per mile rockets up in cold weather. I live in MD. I drive barely 40 miles but my driveable mileage drops by 80 miles or more. The advice from Tesla asks you to reduce comfort settings in the cabin!

A good rule of thumb is from 1 cent per mile, it shoots up to 2 cents per mile. So, four months in a year in my zip code (20854), the cost is double the usual. I own fossil fuel car also, I never see such a dramatic change in mpg.
Please compare cars for 70°F cabin temperature. In gas cars, recycling of engine heat helps, I think.
Hope you found this useful. If you need any further information please let me know.

I would like to point out that your MPG calculation is a little bit wrong, here is an example:

Avg gas prices in US is $2.5 and avg electricity prices in US in $0.12 what means that ~$2.5 / 0.12 = 20.833 => 21, which means the price of 1 gallon of gas is equal to 21 kWh electricity.

2018 Chevrolet Bolt EV
[HYPERLINK "https://www.google.com/search?rlz=1C1CHBF_enUS769US771&q=2018+chevrolet+bolt+ev+range&stick=H4sIAAAAAAAAAOPgE-LVT9c3NExPyallKTTL1VLKTrbSTywtyc_NL8ksS9XPzU9JzYmvTE0sskotiy9KzEtPBQBqVqW_NQAAAA&sa=X&ved=0ahUKEwisvaeA74_aAhVP82MKHQeKDnsQ6BMIowIoADAb" \t "_blank"]: 238 mi battery-only
[HYPERLINK "https://www.google.com/search?rlz=1C1CHBF_enUS769US771&q=2018+chevrolet+bolt+

Ex. 5 Deliberative Process (DP)

ev+battery&stick=H4sIAAAAAAAAAOPgE-LVT9c3NExPyallKTTL1dLMTrbSTywtyc_NL8ksS9XPzU9JzYmvTE0sskpKLClJLaqMLy7NzU0sqgQAfmP_KTwAAAA&sa=X&ved=0ahUKEwisvaeA74_aAhVP82MKHQeKDnsQ6BMIrAIoADAe" \t "_blank"]: 60 kWh

238 / 60 = 3.9666 => ~4 mi per 1 kWh
4 x 21 = **84 is the real Bolt MPG** instead of 119 (or even 128 / 110)

Nissan Leaf 2018
[HYPERLINK "https://www.google.com/search?rlz=1C1CHBF_enUS769US771&q=2018+nissan+leaf+range&stick=H4sIAAAAAAAAAOPgE-LVT9c3NExPyallL0w311LKTrbSTywtyc_NL8ksS9XPzU9JzYmvTE0sskotiy9KzEtPBQATgvAhNQAAAA&sa=X&ved=0ahUKEwiQmZLe8Y_aAhVK9WMKHXRoD8EQ6BMItQEoADAR" \t "_blank"]: 151 mi battery-only
[HYPERLINK "https://www.google.com/search?rlz=1C1CHBF_enUS769US771&q=2018+nissan+leaf+battery&stick=H4sIAAAAAAAAAOPgE-LVT9c3NExPyallL0w319LMTrbSTywtyc_NL8ksS9XPzU9JzYmvTE0sskpKLClJLaqMLy7NzU0sqgQAk37MdDwAAAA&sa=X&ved=0ahUKEwiQmZLe8Y_aAhVK9WMKHXRoD8EQ6BMIuwEoADAT" \t "_blank"]: 40 kWh

151 / 40 = 3.775 => ~3.8 mi per 1 kWh
3.8 x 21 = **79.275 MPG** instead of 112 (125 / 110) on your website.

-----------(separate email)--------------

The price of 1 gallon of regular (currently $2.60) is equal to 33.705 kwh * $0.13 per kWh which equals $4.38 for an equivalent amount of electricity.", so you are basically saying that $2.60 is equal to $4.38 ?

1 gallon is equal to 33.705 kWh from the energy standpoint, but not from the price.

Ex. 5 Deliberative Process (DP)

I'm pointing that per price comparison right now 1 gallon ($2.60) equals to 20 kWh ($2.60 / $0.13 kWh).

My point that energy comparison of 1 gallon to 33.7 kWh is misleading to the customers since 1 gallon will always be equal to 33.7 kWh. In reality people care about cost efficiency not energy and that's why MPG is a simple measurement since it is linked to a price of 1 gallon.

For example if tomorrow, for some reasons gasoline will increase in price or electricity will decrease, than the relative MPG for electric cars should also change, but in your calculations it will stay the same no matter what is the price on electricity/gas right now.

The good example here would be if a customer has $2.60 and he decides which car will go longer for that money:

Assuming conventional car has 20 MPG, it means that I can buy 1 gallon of gasoline and go 20 miles.

For electric cars it means that I can buy only 20 kWh of electrical energy and go 72 miles (Bolt) or 67 miles (Leaf)

but according to your website I should be able to go 33.7 * 3.6 m/kWh = 121 miles what is simply impossible because there is no way to buy 33.7 kWh for $2.60.

Ex. 5 Deliberative Process (DP)